SCIENTIFIC AMERICAN

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NEWARK BAY DRAW BRIDGE.

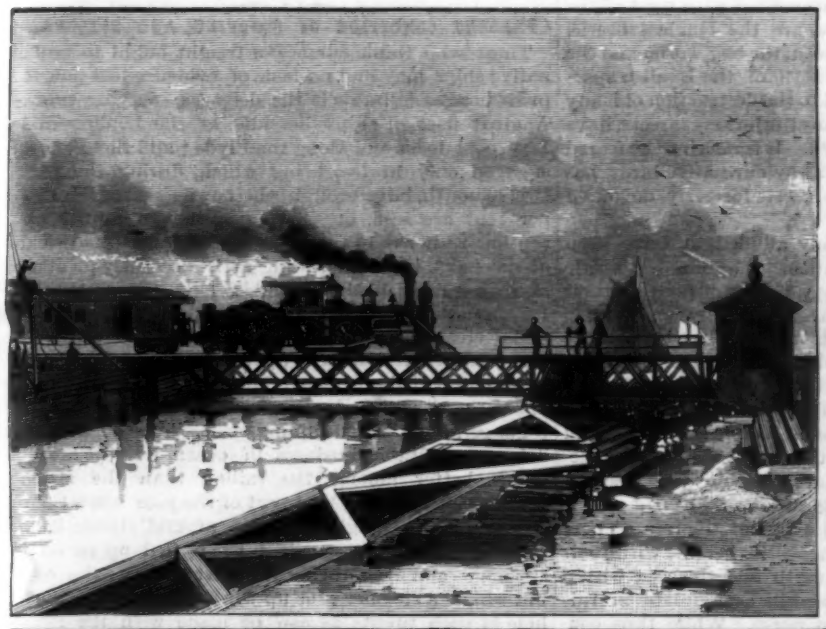
The Central Railroad of New Jersey crosses Newark Bay upon a trestle nearly two miles long. Near the eastern end of the trestle is a draw span which, after having performed its duty for many years, and been re-enforced to enable it to accommodate heavier loads, is now being replaced by one more in keeping with modern practice, and better proportioned to carry the heaviest engines now built, and to provide for any increase that may take place in the future. The old draw was moved by hand, a couple of men turning a crank connected with a simple system of gearing. The opening and closing of the bridge was consequently a very slow operation, and seriously delayed the traffic of the road. The new draw will be provided with the most improved machinery, placed in an overhead engine room at the center of the span, and powerful enough to quickly move the bridge under all circumstances.

The first proposed method of doing the work was to raise the old draw upon floats and remove it, putting the new one in place in the same way. This plan, although economical and expeditious, was abandoned, owing to the difficulty that would have arisen had the center pier and abutments been found to be out of level, and a temporary side track and single opening draw were built. The location of these is clearly shown in the accompanying engravings, in which it will be seen that the side track, carried upon piles, is extended sufficiently far from the main line to permit the erection of the new draw upon its center pier.

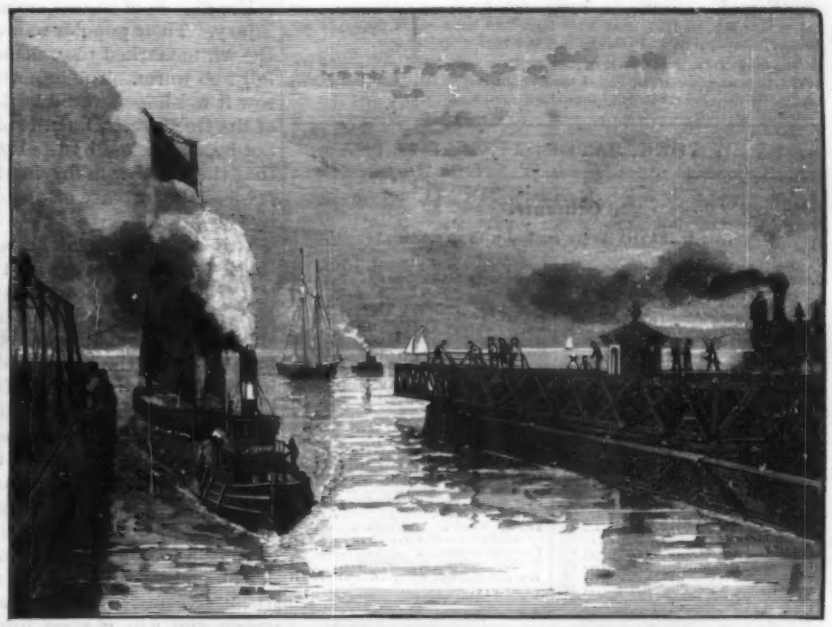
The two upper engravings show the small temporary draw in both its closed and opened positions. This draw has a total length of 97¾ feet, and it is so pivoted that its short arm is 30¼ and its long arm 67½ feet. The difference in the weight of the two arms is counterbalanced by pig iron placed at the extremity of the short arm. The draw is composed of four girders, latticed in pairs and united to form a box six feet deep and six feet from center to center of girders. The draw turns upon four wheels 20 inches in diameter, arranged at equal distances apart and rolling upon a track circle eight feet in diameter. Placed concentrically with its circle is a large gear, meshing with which is a pinion on a vertical shaft carrying at its upper end a second gear, in engagement with which is a pinion, to the shaft of which the crank is applied for operating of the draw. When opened, this bridge rests parallel with the eastern abutment of the permanent draw.

The new draw, of which we present a side elevation and cross section, will be 217 feet between centers of end piers, and 28 feet center to center of trusses. It will be noticed that the bridge consists practically of two independent spans, having inclined end posts and united by a center panel resting upon the pier. The inner ends of the bottom chords abut against the bottom member of the center panel, and which is proportioned to resist the compression thus brought upon it when the free ends of the bridge are unsupported. The inner end of each of the top chords is united to the top of the center panel by four bars five inches wide by 1⅝ inch thick. These bars support the weight

(*Continued on page* 340.)



Temporary Draw Closed.



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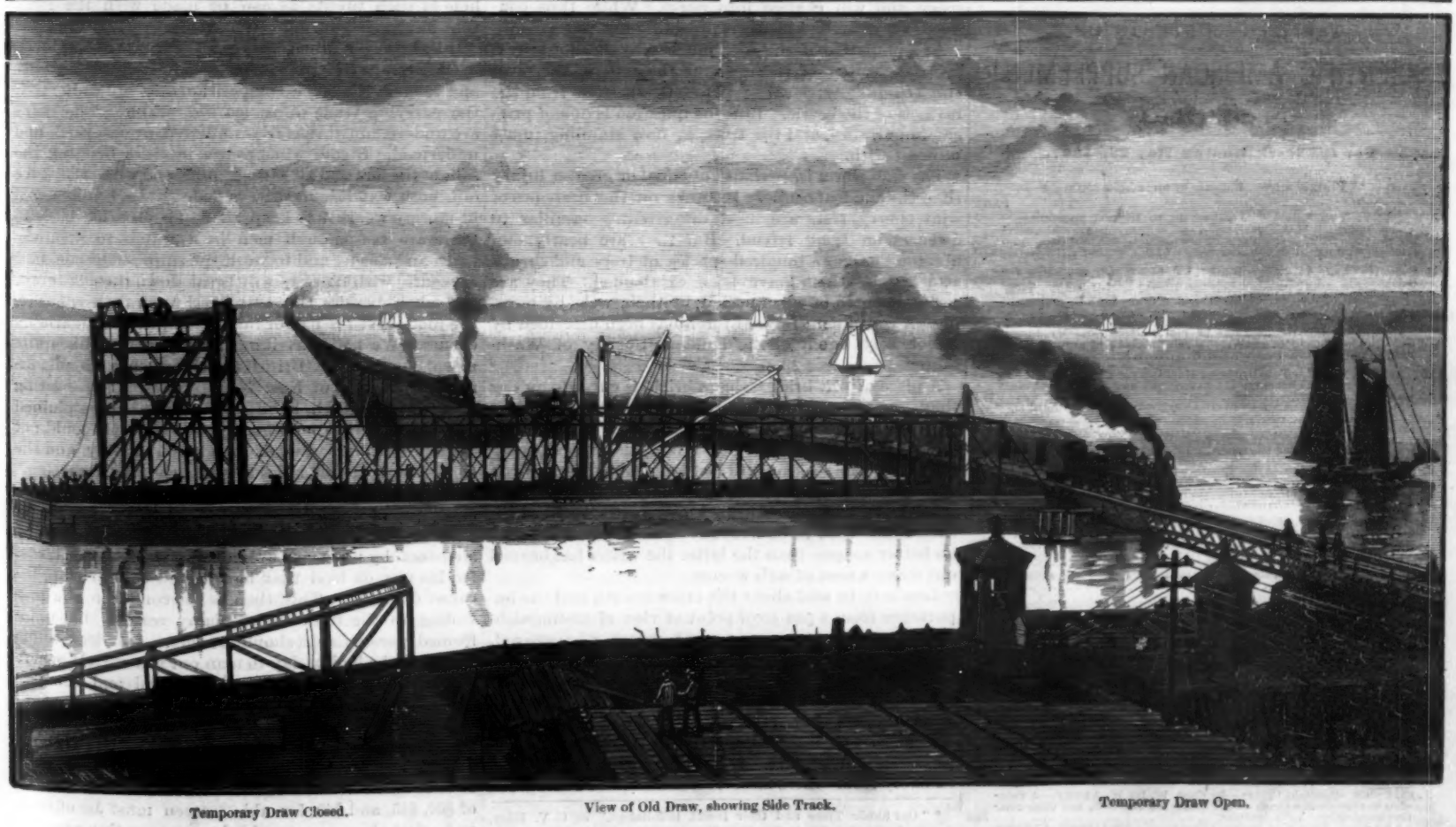

View of Old Draw, showing Side Track.

NEW DRAW BRIDGE OVER NEWARK BAY ON THE N. J. CENTRAL R.R.

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NEW YORK, SATURDAY, MAY 28, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 595.

For the Week Ending May 28, 1887.

Price 10 cents. For sale by all newsdealers.

THE PROTECTION OF SHADE TREES AGAINST INSECTS.

For many years the destructive effect of insects upon the shade trees in our city parks and in some parts of the country has been very marked. While an absolute destruction of the tree is rarely brought about, yet in many cases it is so completely denuded of foliage in the course of a season that it loses all its beauty and utility. Of the ordinary trees, the elm is perhaps as badly attacked as any. Certain species are particularly affected by insects, and it has now become a question of widespread interest how to deal with them. New Haven, famous for its elms, has suffered a great deal. Various means have been adopted to protect the trees. Annular troughs filled with coal tar or straw ropes coated with the same have been placed around the trunks near the lower branches, in order to intercept the march of the destroyers. Sometimes lime is scattered around the roots, or the trunk is scraped and whitewashed. These remedies have proved of value, but are far from complete.

Recently the attention of the U. S. Bureau of Entomology has been called to the condition of the trees in the park and capitol grounds in Washington. This brought forcibly before them the fact that a problem of much importance was to be dealt with, because the trees of other Eastern regions manifestly were exposed to the same influences that were so destructive to those in Washington. Accordingly, the chief entomologist, Prof. C. V. Riley, devoted considerable attention to the causes of the trouble, the natural history of the destructive insects, and to the most effectual way of dealing with them. The results are embodied in a pamphlet issued by the U. S. Department of Agriculture.* In it the subject is treated in an admirable manner, and the pamphlet should be in the library of every one interested in forestry and arboriculture.

Four kinds of insects are accredited with most of the injury. Their popular names are the elm leaf beetle, the white-marked tussock moth, the bag worm, and the fall web worm. The importation of the English sparrow it was hoped would lead to the destruction of many of the tree insects, but the most injurious insects have not been attacked by the birds. It is rather to be feared that the sparrow in driving away our native birds has favored the increase of the insects formerly devoured by the latter.

Various methods, as already alluded to, have been suggested for dealing with them. The elm leaf beetle (*Galeruca xanthomelana*) may be intercepted on their travels up and down the tree trunk by some adhesive girdle or trough. Sheets may be placed under the branches, and the larvæ and adults shaken into them by jarring the branches. The larvæ descend the tree trunk when they are fully grown, and, on reaching the ground, establish themselves near the tree and develop into pupæ. In the two weeks of larval life between the egg and pupa stages, they do their destructive work. This habit suggests one treatment. It is to build low boxes around the base of the tree. These may be a foot or eighteen inches in height, with their bottom edges sunk in the earth and the area within them cemented. The larvæ will accumulate in this space, and will change into pupæ. While thus confined, they can be killed with scalding hot water.

As a palliative of the evil, much may be done by a proper selection of trees. Thus the native American elm (*Ulmus Americana*) is practically free from the ravages of the beetle. But the question is one of present importance, and the trees, as now standing, must be dealt with.

The web worm is, perhaps, of equal or greater injury than the elm leaf beetle. Its webs on the branches of wild cherry trees are most disagreeably familiar to dwellers on Long Island. But they are nearly omnivorous. Over a hundred species of trees and shrubs attacked by them have been catalogued. They are easily disposed of when nested in their webs by burning. A convenient form of torch has been described by Major Key, agent of the Humane Society of Washington.

A piece of soft brick (salmon brick) is cut into an egg shape, and is suspended by wire to the end of a pole. This is saturated with kerosene. When lighted, it is held against the nests, and effectually destroys them by burning. One soaking will last long enough to destroy a number of nests. This is manifestly an improvement on the old kerosene-saturated newspaper with which destruction used to be wrought upon the webs. With no better weapon than the latter the writer has burned out many a nest of web worms.

Less is to be said about the other insects, and the importance from a practical point of view of distinguishing between them has, to a great extent, disappeared. The reason for this is that one effectual way of destroying them all has been developed. It consists in spraying the trees with arsenic compounds suspended in water. A spraying in the middle of May, followed later by one or two more at intervals of two weeks, will protect all kinds of trees from the four insects, and presumably from others also. White arsenic or Paris green may be employed, but "London purple," a residue from the manufacture of coal tar dyes, is recommended as less liable to burn the leaves than either of the others. It also is easier to suspend in water than is Paris green, settling out more slowly therefrom, and owing to its color, poisoned trees can be distinguished from those not treated—a matter of some importance. From one-quarter to three-quarters of a pound is enough for a barrel (40 gallons) of water. With it should be mixed three quarts of cheap or damaged flour. This makes the poison adhere, and prevents it from burning the leaves. For young and delicate trees, not over half a pound to the barrel of water should be used. If Paris green is employed, as much as one pound may be mixed with the barrel of water.

A good spraying nozzle, several of which are described in Professor Riley's monograph, is mounted on a rod and connected by a hose with a pump in the barrel. The mixture is constantly agitated, and pumped up through the nozzle over the leaves of the trees. On the large scale the water may be carried in a special watering cart, and may be applied by three or four men to the trees on each side of a street or avenue. On the smaller scale a pail may be used to carry it about from tree to tree, and one of the well known hand pumps will answer to distribute it. The form of the nozzle and proper stirring of the powder in the water are the important points in the process. The operator should also remember that he is dealing with a deadly poison, and take every means to keep it from his person. A circular disk of leather should surround the pole near its top, to intercept any water running down it. A calm day should be selected, and due regard paid to any wind, in order that the spray may not be blown away from the trees, and upon the men applying it.

* "Our Shade Trees and their Insect Defoliators," by C. V. Riley, Entomologist, Washington, 1887. U. S. Department of Agriculture, Bureau of Entomology, Bulletin No. 10.

PRESENT CONDITION OF SHIPPING AND SAILORS.

Those who think our ocean freight ought to go in native ships may find no lack of evidence just now to prove how undesirable is the deep-sea carrying trade. A great fleet of ships lies idle at the London and Liverpool docks and along the Clyde; and those afloat engaged only in freighting which, during the past twelvemonth, have brought their owners more than 2½ per cent are said, on good authority, to be the exception rather than the rule. Commander Chadwick, of the navy, in an interesting article recently printed, says that English ship building fell off 50 per cent in 1884 from the tonnage turned out in the preceding year, and decreased another 50 per cent in 1885. For several years there has been a tendency to build sailing vessels, and at the present time it is the construction of such craft which alone suffices to maintain English tonnage above the declining scale. The chances of doing a profitable business in ocean freights are, it seems, better among the sailing than the steam fleet, because, during that part of the year when there is not enough freighting to go around, there is no such loss on a sailing vessel when tied up as on a steamer; and even during the best months the coal bill which a steamer runs up when afloat makes a big hole in such profits as can be made with the rates that have ruled during recent years.

It is, however, when we consider the means employed in the average freighter to keep down running expenses and to meet the fierce competition now obtaining that the carrying trade seems least desirable. The ships are undermanned, the crews underfed, overworked, and underpaid. Steam winches are used for hoisting the sails of the fore and aft sailing ships, and when they give out, both watches must be called. Indeed, it is usual in stormy weather to keep all hands on deck, because there are not enough men in a watch to man the tacks and sheets, and to work the ship. This constant exposure, with no rest, will break down the best crew, and when, besides this extra call upon their energies, the food served is bad or insufficient, illness invariably ensues. We had a striking illustration of this quite recently, when the British merchant ship Albania arrived at the port of New York from Manila, reporting three dead and all hands ill. The men complained that the food they got at sea was so bad they could not eat it. The flour was sour, the bread mouldy, and the corned beef, served twice a week, simply "revolting." Pea soup was occasionally served, but this was generally full of worms.

It would seem as if the master or owners, following a custom by no means unknown in the Atlantic trade, fed his men on food that had been bought cheap, because damaged. This, then, is the condition now prevailing in the trade which many zealous, but unin formed, persons insist should be ours. American sailors are not to be had to-day to man our war vessels, where the food is always good and plentiful and the pay $21.50 a month—not so bad when the general conditions of service are considered. Our war ships are manned by foreigners—Danes, Swedes, Norwegians, and Hollanders; and in order to encourage the Yankee to take again to the seas, the old and liberal wages of $30, $35, and $40 for able seamen must be offered, and a first class mess provided. Given such wages and food, the Yankee skipper could not compete with the

"lime-juicer" and the "tramp" steamer. When another Plimsoll shall appear, and the welfare of sailors be as carefully looked after as the "load line," then perhaps the fisherman and the "beach comber" will be induced to ship. Until then we are likely to let foreigners carry our ocean freights, for the rather good reason that they seem willing to carry them cheaper than we can afford to carry them ourselves.

The Black Bees of Tasmania and their Medicinal Honey.

In a recent communication to the Paris *Academie de Medecine*, which is published in the "Progres Medical" for April 16, Dr. Thomas-Caraman, of Forges-les-Eaux, reported upon a matter which must be regarded as among the most notable of the therapeutic novelties of the day, being nothing less than the discovery of a sort of honey possessing in a remarkable degree the medicinal properties of the *Eucalyptus globulus* or of some species of *Eucalyptus*.

It seems that, about three years ago, a distinguished French naturalist, M. Guilmeth, who was traveling in Tasmania, came suddenly upon a grove of gigantic eucalyptus trees, from 260 to 390 feet high, and with a trunk so large at the base that it took forty of his Kanackas, joining hands, to reach around one of them. High in these lofty trees he discovered what he at first took to be enormous galls, but which he soon ascertained were the dwelling places of swarms of small, black, wild bees, of a variety before unknown to him. Dr. Thomas-Caraman proposes for this bee the provisional name of *Apis nigra mellifica*. Besides being black and smaller than the ordinary honey bee, this wild bee has its languet rather more developed than that of the domestic bee. M. Guilmeth attempted, unsuccessfully, to domesticate it in Tasmania. He caused some of these immense trees to be felled, and secured the honey. The largest individual store of honey weighed as much as 11,000 pounds avoirdupois.

The honey is described as a thick, homogeneous, somewhat transparent, sirupy liquid, of a deep orange color; having an odor suggestive at once of its containing eucalyptus principles; very soluble in water, in milk, and in wine, but much less soluble in alcohol; and very difficult of fermentation. Its specific gravity is 1·44, and it rotates the polarized ray 22°. In round numbers 1,000 parts contain 611 of invert sugar (mostly levulose), 2 of ash, 215 of water, and 171 of active principles, including eucalyptol, eucalyptene, terpene, cymol, and odorous, resinous, and coloring matters. Its taste is described as very pleasant. Administered to dogs, to the amount of from two ounces and a half to five ounces a day, its slows the heart's action, and this effect soon becomes so pronounced as to suggest, in Dr. Thomas Caraman's words, a struggle between the pneumogastric nerve and the cardiac ganglia. At the same time the temperature falls about 1° C. The effects last for at least twenty-four hours, and include a slight tendency to sleep, but without any symptom of toxic depression. As the result of experiments on himself and on one of his friends, Dr. Thomas-Caraman states that, on taking a tablespoonful of the honey in a little tepid water or milk, after a few minutes one perceives a gentle, agreeable warmth take possession of the whole person. At the end of half an hour, the elimination of the active principles by the air passages having begun, the voice becomes clearer and the breath perfumed; the lungs feel more elastic, more supple. Having continued the use of the honey for a week, four tablespoonfuls daily, the author, who speaks of himself as respectably fleshy, found that he could go up two pairs of stairs, two steps at a time, without stopping to take breath or feeling at all blown. At the same time there was slight diuresis with an increase of urea, and the urine had a decided odor suggestive of that of the *Acacia farnesiana* (the plant from which the perfume called "new mown hay" is made).

Besides his observations of the physiological action of the honey, the author cites certain trials of it as a medicine. These data lead him to consider it a valuable aliment, an efficient and palatable substitute for cod liver oil; an anticatarrhal; an agent affecting the heart in a manner comparable to the action of digitalis, but free from the inconvenient properties of that drug; a febrifuge; an antiparasitic specially applicable to the destruction of the micro-organisms of tubercular and scrofulous neoplasms, the *Leptothrix vaginalis*, and oxyures; and, finally, an antiblennorrhagic, by virtue of its being more actively eliminated by the uro-genital tract than either copaiba or sandal oil. It is destined, he thinks, to play a great part in the treatment of laryngeal, bronchial, pulmonary, cardiac, and scrofulous affections; in malarial and typhoid fevers; in whooping cough and influenza; and in renal, vesical, and vaginal troubles.

It may be said that Dr. Thomas-Caraman holds up to our view a somewhat rose colored picture, but it must be confessed that there is no inherent improbability in the notion that an animal organism like that of the bee may be able to elaborate the medicinal principles of the eucalyptus in greater perfection than the art of pharmacy can furnish them. Should his impressions be confirmed, however, the practical question at once comes up as to the extent to which commerce can supply us with the genuine wild honey of Tasmania, and it is much to be feared that, in case of any considerable demand, we shall witness a repetition of what took place in connection with the supply of Chian turpentine and, more recently, that of alveloz—the substitution of products more or less adulterated, if not wholly factitious. It would be interesting to know to what particular species of the genus *Eucalyptus* the gigantic trees found by M. Guilmeth belong. Perhaps the active principles of the tree may yet be made available without the intervention of the *Apis nigra mellifica.—N. Y. Med. Jour.*

Brotherhood of Locomotive Firemen.

Some of the lodges of the thirty thousand locomotive firemen held a meeting in Tammany Hall, New York City, on Sunday afternoon, May 15. Addresses were made by Mayor Hewitt, Chas. A. Dana, and others.

Mr. Chauncey M. Depew, introduced as president of the New York Central, was received with enthusiastic and prolonged applause, renewed again and again. He said in substance:

"I have been led to believe that the fireman is the most popular of all the employes in the railroad service. Out of every hundred applications I get for positions, ninety are for 'fire.' If I get off at a way station anywhere, the farmers' boys who want work all ask for never anything else but 'fire.' The American boy wants excitement, work, and opportunity to rise; and when he sees the train hurrying across the meadow, the fireman before the open door of the furnace, glowing like a demon in the red glare, is to him a type of progress. He knows it is exciting, he knows it is hard work, but isn't afraid of it, and he knows there is promotion when the time comes and he is worthy of it. (Applause.)

"I believe in organizations like yours, and I like your motto, 'Protection, charity, industry, and sobriety.' The two best anti-poverty medicines in the world are industry and sobriety, and the two best anti-poverty societies in the world are the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen. (Tremendous applause.) They have already abolished poverty so far as they are concerned.

"We hear a great deal nowadays about the bloated capitalists and monopoly. Into the New York Central Railroad a few capitalists put their millions, the farmers put their few thousands, and the widows their $400 or $1,000. And this is the 'grasping monopoly.' It is a co-operative society for running a railroad, and you and I are its employes. I have come down to talk to my fellow employes, and have put on my best Sunday clothes. (Laughter.) Now, this road will earn about $34,000,000 this year. The 'spouter' hears this, and declaims about its being taken out of the people and put into the pockets of the capitalist. But out of it comes $12,000,000 for wages—you and I get that; $8,000,000 for taxes, and $10,500,000 for repairs, mostly for labor, leaving something over $3,000,000 for dividends. So that the bloated capitalist pays out $31,000,000 for labor and bloats on $3,000,000. None of 'em have burst yet, I believe." (Laughter.)

Other addresses were made by Mr. J. J. Hannahan, the Vice Grand Master, and E. V. Debs, the Grand Secretary and Treasurer of the Brotherhood.

An Invention Wanted.

At a recent meeting of the Engineers' Club of Philadelphia, the secretary presented, for Mr. Edwin Ludlow, notes on the preparation of anthracite coal. Mr. Ludlow says:

"I desire to call the attention of the members of this club, and especially those who are mechanical engineers, and have the bump of inventiveness well developed, to one of the greatest needs now met with in the preparation of anthracite coal. While engineering ability and mechanical skill have done wonders during the last decade toward putting the mining and preparation of coal on a scientific basis, making it possible to ship as high as 2,600 tons of prepared coal from one breaker in a single day, still in every breaker, no matter how modern it may be, one will find the chutes, through which the coal passes from the screens to the loading pockets, lined with boys from twelve to fourteen years of age, who sit there ten hours a day picking by hand the slate from the coal as it passes along. The atmosphere of this screen room is, in many cases, so laden with fine coal dust that objects cannot be distinguished twenty feet away; and while the breathing of this coal dust does not seem to have any immediate effect on the boys' health, it undoubtedly lays the seeds for the bane of the coal region—miner's consumption. Its strikes every thoughtful man who looks down on from one hundred to two hundred boys working in a single breaker, that it is a very crude and expensive way of preparing coal.

"Various appliances have, of course, been designed, but the only really successful one, as proved by actual experience, has been the water jig. This undoubtedly removes the slate with a small percentage of waste of coal; and where the product of the mine is wet, and water has to be used on the screens to effect a separation of the dirt from the coal, it is the best and most economical appliance that can be employed. But the greater part of the coal going to market comes from dry mines, where it would be a detriment to the quality of the coal, and a great expense, to use water.

"The waste water from the jig is also expensive to take care of, as in most localities it is no longer allowable to let it run, with the fine dirt it holds in solution, into the nearest creek, as the sediment will carry a long distance, and invariably deposits itself where it will do the most harm, and entail a heavy suit for damages. Enough tanks have therefore to be provided to allow all the waste water to thoroughly settle, so that the water and culm can be removed separately. Water itself, or rather the pure article, is both scarce and expensive during a part of each year throughout nearly the whole region.

"And if mine water is used, as is generally the case, the acid contained in it attacks the iron work of the jig and makes frequent repairs necessary.

"The principle the jig works on is based on the difference in specific gravity between coal and slate. The two enter the bottom of the jig together, and by the pulsations of a large plunger in an adjoining compartment, water is forced up through the coal, lifting it, and allowing a fresh supply to come in. The coal is forced to the top and runs off with the water, while the slate, owing to its greater specific gravity, passes out through a separate opening in the bottom.

"Now what is needed, and what I hope some member of this club will devise, is a dry jig, in which this separation will be effected by the use of air instead of water.

"One of the difficulties encountered in getting up such a jig is caused by the care with which coal has to be handled to prevent its chipping or breaking. It cannot be dropped on to iron or wire or to itself without producing an appreciable percentage of waste. With the most approved rolls, the loss in rebreaking any size to a smaller one amounts to from 10 to 15 per cent.

"While the difference in specific gravity between coal and slate of the same sized pieces is very great, still trouble would be experienced in any separation by an air current with flat pieces of both slate and coal, on which the action of the air would vary according to whether it acted on the edge or the whole side.

"The man who invents a successful dry jig that will stand the test of actual trial will undoubtedly make a very handsome thing by it.

"Not to be too cumbersome, a single jig should not have a greater capacity than 500 tons per day; and as the shipping capacity of the anthracite region is about 200,000 tons per day, it would take about 400 to supply the trade.

"I shall always be most happy to furnish any information or give any assistance in my power to any one desiring to work on this matter."

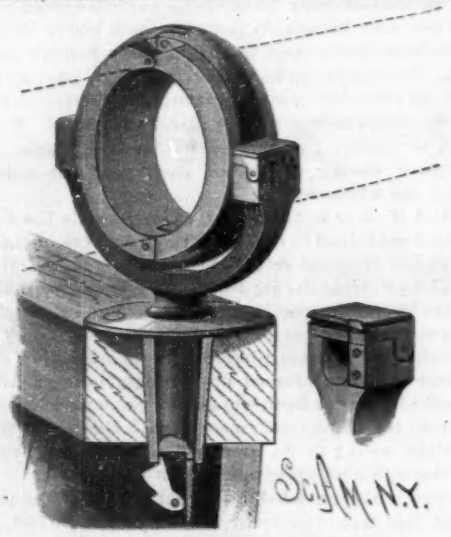
The Grant Relics.

The Grant relics, which have been for several months safely guarded in one of the private rooms of the National Museum, are now on public exhibition. Recently, two handsome plush lined cases, filled with articles from the collection, were placed in the north hall of the museum, near the main entrance. They contained the presentation swords, gold headed canes, caskets, medallions, and many other costly and elegant articles presented by different people at different times to General Grant. Many of these articles are souvenirs of his trip around the world. There is a splendid collection of Japanese coins, one series of seven pieces, old Japanese gold coins of huge size, being valued at $5,000. There are also invitation cards, menu cards, and reminders of entertainments given in his honor, engrossed on gold plates. One invitation card to a masked ball given at San Francisco upon General Grant's arrival at that city, on his return from his famous tour, is engraved on solid gold, and was inclosed in a silver envelope, with the address engraved upon it. In the right hand corner is a two cent stamp and in the left the usual "If not delivered in ten days return to," etc. The articles shown, besides their historical interest, are of great intrinsic value.

WE never can tell, says the American *Railroad Gazette*, what arguments will have weight with some men. The latest number of the *Memoires de la Societe des Ingenieurs Civils* gives a long discussion of the project for a metropolitan railroad in Paris, and the most serious reason given for an elevated rather than an underground route is that "the people of London are very different from those of Paris. In London, for two-thirds of the year, the climate is gloomy, cold, and unwholesome, above as well as under ground. The streets are almost always muddy, and these reasons, which make the underground way quite endurable there, do not apply to Paris." Another speaker reasoned that Parisians "would rather be swallows than moles."

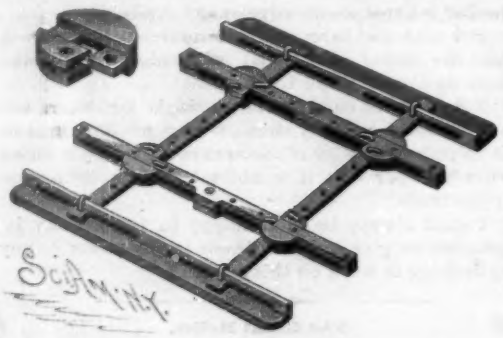
IMPROVED OAR LOCK.

In this oar lock simplicity and strength are combined with lightness, and there is perfect freedom in the handling of the oar, which will not unship in the roughest weather. Clamped around the oar is a hinged ring, the edges of which have outwardly projecting flanges. This ring is fitted to turn within another hinged ring having trunnions, by which it is mounted in the frame in the boat bracket. These two rings constitute a fixture upon the oar, and are made as light as possible, consistent with the wear and strain brought



TOMPKINS' IMPROVED OAR LOCK.

to bear upon them in rowing. The boat bracket is secured to the gunwale, and has a downwardly projecting tubular arm, in which the shank of a U-frame is held by a spring pin at its lower end. The bracket is not necessarily a portion of the oar lock, as the shank of the frame can be attached to various styles of boats in a multiplicity of ways. In the upper extremities of the frame are journals to receive the trunnions of the outer ring, one journal being positively inclosed at the top and provided with an inner vertical recess to facilitate the insertion of the trunnion, and the other being open and provided with a hinge cap, as shown in the



MEGORDEN'S IMPROVED PRINTER'S CHASE.

small view. A properly arranged spring holds the cap in its closed horizontal position. When it is desirable to receive the oar, the cap is thrown back against the pressure of the spring, or the spring is bent inward to release the cap. The oar can be readily and safely adjusted in the frame or removed therefrom. This oar lock relieves the strain of the oar upon the hand at the entrance of the oar, and to a great extent upon the stroke. It prevents the oar from slipping inboard and outboard, and permits the ready and very easy accomplishment of the movement necessary for feathering.

This invention has been patented by Mr. Alfred H. Tompkins, of 70 Hancock Street, Brooklyn, N. Y.

IMPROVED PRINTER'S CHASE.

The top and bottom pieces of the chase, for attachment to a job press, as usual, are provided with raised longitudinal strips formed with slots in which the ends of the side pieces are movably held by staples or clips. The end strips, between which and the side pieces the form is locked, are longitudinally slotted to receive the side pieces through them. Both side and end strips are formed with rows of holes to provide for their respective adjustments nearer to or farther from each other. The corner holders, the form of which is clearly shown in the upper left hand view, serve in connection with the pins passing through them and through the strips to lock the strips to their places when adjusted. These holders also serve to couple and guide and keep parallel with each other the side and end strips. The holders have slots through them to receive the side strips, and upper and lower transverse grooves to receive the slotted end strips, and have holes formed in them to receive the pins. One portion of each holder is cut away, so as not to protrude within the space in which the form is held. It is evident that when the pins are withdrawn, the side and end strips can be adjusted as required; in this way the chase, which is made of steel or iron, can be adjusted to lock up any size or shape of form, from a single line to a square or larger form.

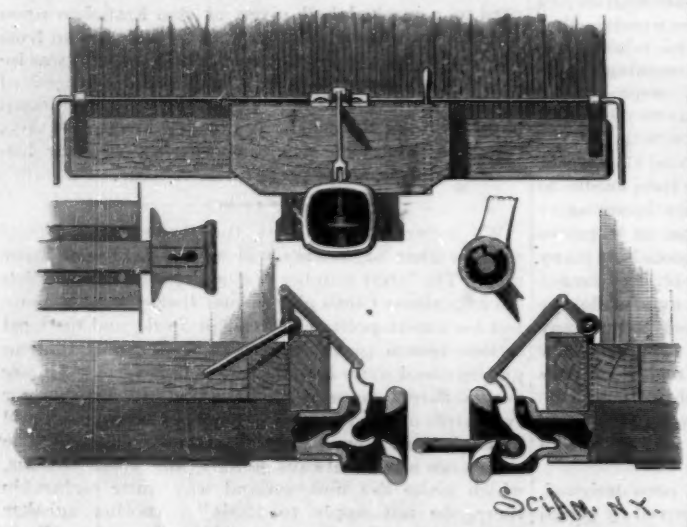
This invention has been patented by Mr. Holiver Megorden, of Farmington, New Mexico.

IMPROVED CAR COUPLING.

The drawhead in this car coupler is formed with outwardly extending side ears, as shown in the left hand inverted plan view, the drawbar being connected with the car body and with its spring in the usual manner. The drawhead is also formed with a hooked prong extending upward and toward the rear from the bottom of the link recess, the outer face of the prong being convex, while its inner face is concave. Back of the link recess is a vertical recess, extending entirely through the drawhead, a forwardly extending horn being arranged at the rear of the recess. Within the recess is mounted a swinging hook shaped as clearly shown in the lower view, and which is connected, by a link, with a lever arm carried by a sleeve loosely mounted upon a crossbar supported by brackets secured to the end of the car. The bar is formed with a bit, and the sleeve has an inside flange or feather, as shown in the small view. Upon each end of the crossbar is a lever arm or handle.

The operation of this coupler is as follows: A coupling link inserted in the drawhead recess rides up over the convex face of the hook or prong, behind which it drops above the lower point of the swinging hook, the parts then being about in the position shown in the lower right hand view. As the link enters the opposite drawhead, its forward end strikes against the hook and forces it to the position shown, and drops down behind the prong. The cars can be uncoupled by turning the lever arms to raise the hook, which will carry the link above the point of the prong and permit its withdrawal. The position of the link can be regulated by so turning the lever arms as to carry the hook downward, and thereby raise the projecting end of the link; by turning the arms in the reverse direction, the outer end of the link can be depressed. To lock the parts against automatic coupling, the hooks are held in an elevated position. The accidental removal of the hook is prevented by a pin passed through the drawhead behind the hook. Should the hook or any part of the operating mechanism break, the coupling may be brought about by means of an ordinary coupling pin, which is carried in a proper recess formed in the head block. As the cars provided with this coupler come together, any undue strain upon the drawbar spring is obviated by the peculiar form of the drawhead, the ears or shoulders of which abut against the buffer block, and thus relieve the spring from any undue strain.

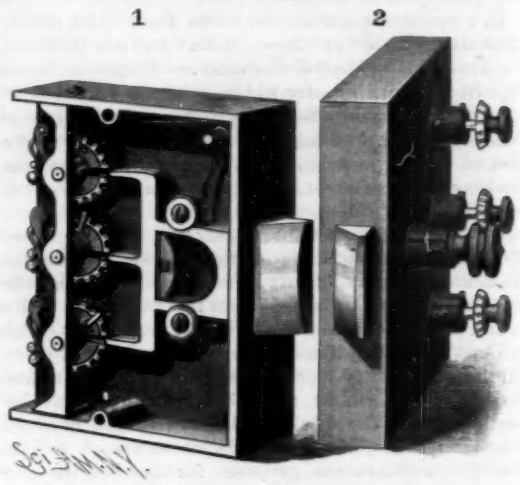
This invention has been patented by Mr. Eusebe Lalime, of Malone, N. Y.



LALIME'S IMPROVED CAR COUPLING.

IMPROVED COMBINATION LOCK.

This combination lock is the invention of Mr. George R. Boyce, of Orange, N. J. It can be quickly set to any combination desired, is easily locked and unlocked, and is very simple in construction. In the casing slides a bolt normally held projected by a spring, and retracted when released by a permanent key with spindle and head. The bolt, in this case, is formed with three prongs and is locked, when projected, by its prongs striking the peripheries of three setting wheels. When retracted, the prongs enter deep radial slots in the wheels. The peripheries of the wheels are normally presented to the prongs to lock the bolt by coiled springs which act to turn the wheels, the position of the radial slots with respect to the prongs being determined by lugs projecting from the wheels striking against stop pins. The wheels are turned forward against the tension of the springs to present their slots to the prongs by means of spindles passing through the front of the casing and having turning heads. The forward parts of the wheels are formed with ratchet teeth engaged by pawls pivoted to the casing, which prevent the teeth from being turned back by the springs. The amount which each wheel must be turned to bring it from its original position of rest into position to release its bolt prong can be determined by the audible click of the spring pawl, or an



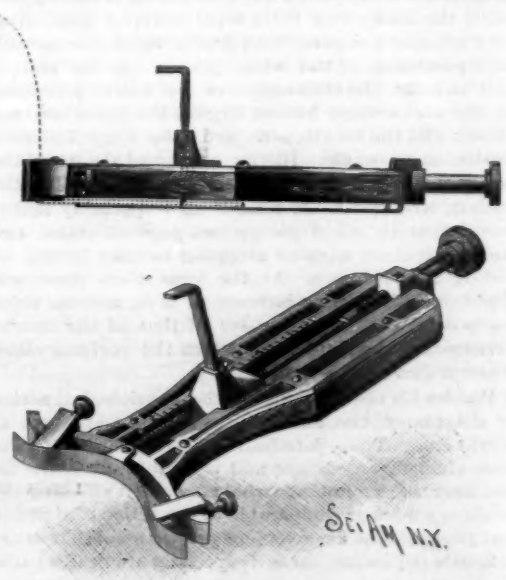
BOYCE'S IMPROVED COMBINATION LOCK.

ordinary index and numbered dial may be employed, if desired.

In order to again lock the bolt after being released, and return the wheels to their original locking position, the ratchets are movably arranged with respect to their pawls by mounting their spindles to slide lengthwise, whereby the wheels can be pushed forward to disengage their ratchets, when they will be immediately returned to their original position by the tension of the springs. On the spindles being released, the springs also serve to press back the wheels into engagement with their pawls. The positions of the stop pins can be varied to change the position of rest of each wheel and the degree of rotation necessary to present the releasing slot to the bolt prong. The stop lug on each wheel can also be independently adjusted. To further increase the difficulty of solving the combination, the spindle of each wheel is provided with a clutch collar held by a spring in engagement with a similar collar on the wheel. By drawing the spindle out slightly it is disconnected from the wheel, and can then be variously adjusted so as to prevent one's noting the motion of the setting wheel by the marks on the turning head or knob.

ROUNDING JACK FOR HAT BRIMS.

The metal frame is provided with a curved breast and formed with a central longitudinal passage



HILD'S ROUNDING JACK FOR HAT BRIMS.

or way for the knife stock. The frame is furnished with a wooden backing having a passage corresponding to that in the frame, but somewhat wider, so as to expose the edges of the frame, and thus form guides for the knife stock. The stock is formed with side grooves to receive the edges of the frame and with a vertical opening to receive the knife, and also with a screw-threaded opening to receive a rod, which acts as a set screw to the knife and as an adjusting rod for moving the stock in the groove to set the knife for cutting any desired width of brim. The rod slides freely in an opening in the frame, and is held in the desired position by a set screw. The upper surface of the frame is graduated to facilitate the accurate setting

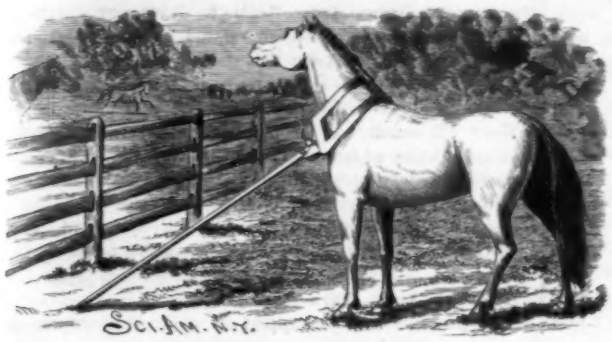
of the stock; and in order to remove the stock, the frame is formed with clearances in the edges at one end of the passage. Upon the wooden backing is detachably secured a guard plate for supporting the brim, shown by the dotted line in the upper view, being cut.

The curved breast is provided with a flexible guard, the ends of which are adjusted by screws threaded into the guard to form a curve of greater or less radius, according to the size of the hat crown. This guard is formed with a central lip held to the breast by a screw.

This invention has been patented by Mr. Michael Hild, of 321 Diamond Street, Philadelphia, Pa.

ANIMAL POKE.

This poke is so arranged that, while the animal is free to graze, it will be impossible for it to move forward while its head is erect. The straps encircling the neck of the animal are secured to two side blocks, between which is pivoted a forwardly and downwardly extending rod. In order that the rod may project forward at a proper angle, a limit pin is arranged in connection with it, so as to rest against forwardly extending arms



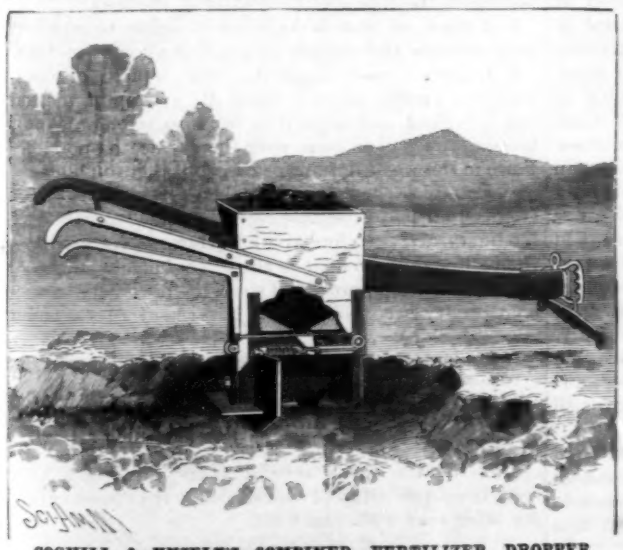
SCHWALM'S ANIMAL POKE.

made integral with the blocks. The forward end of the rod is pointed, the point being formed by beveling or rounding off the lower end from the rear side of the rod. When the device is arranged as shown in the engraving, the animal will be held against any forward movement while its head is erect, as the pointed end of the rod would enter the ground; but when grazing, the head is lowered, and the rod then assumes a more nearly horizontal position, thereby raising the point from the ground and allowing the beveled portion of the rod to slide along the ground. The animal can back and turn freely at all times, but cannot move forward nor jump fences.

This invention has been patented by Mr. Francis Schwalm, of Fort Smith, Arkansas.

COMBINED FERTILIZER DROPPER AND HILL FORMER FOR TOBACCO PLANTS.

The object of the invention herewith illustrated is to provide combined fertilizer droppers and hill formers



COGHILL & UNSELT'S COMBINED FERTILIZER DROPPER AND HILL FORMER FOR TOBACCO PLANTS.

for tobacco plants, constructed in such a way that the fertilizer can be dropped at the proper places, covered with soil to form a hill, and the soil packed to form places for the plants. To the rear end of the beam is attached a vertical standard, just forward of which is secured the end of an upright bar, upon the forward side of the lower end of which is formed a point to cause the end to enter the soil readily. To the rear side of the lower end of the bar is attached the forward end of a horizontal bar, whose rear end passes through a plate secured to the forward side of the standard, and has a nut screwed upon it. To the rear side of the lower part of the upright bar is bolted a plate smaller than the other, and to the lower end of the standard is attached a horizontal plate. To the beam and standard is secured a box or hopper to receive the fertilizer, which is guided to the center of the lower part of the hopper, where it rests upon the dropping plate. In the free end of the plate is formed an aperture to receive the fertilizer and carry it to the discharge opening formed through the hopper bottom, so that no more of the fertilizer can escape through the opening than is carried to it by the aperture in the plate. To the free end of the plate is fastened a cord, which leads to an elbow lever placed so as to be conveniently grasped and operated by the hand to move the plate to drop the fertilizer. The plate is drawn back by a spring to again receive the fertilizer. In using the machine, the land is marked with cross marks, across which the machine is drawn at right angles. The plate carried by the upright bar brushes aside the lumps and crowds and pushes the soil before it, forming a small bank, while the rear plate pushes the soil before it at the same time and forms a larger bank. As each cross mark is reached, the lever is operated to drop the fertilizer, which is scattered by falling upon the horizontal bar, and at the same time the machine is raised, causing the front plate to pass over the soil pushed before it and causing the rear plate to carry forward the upper part of the soil pushed by it, cover the fertilizer, and form a hill to receive the tobacco plants. As this latter plate crosses the mark the machine is lowered, bringing the horizontal plate down upon the top of the hill, marking the hill and packing the soil so that it will not fall in and fill the hole formed by the peg before the plant has been inserted.

This invention has been patented by Messrs. John C. Coghill and Charles H. Unselt, of Woodville, Ky.

THE MOMENTUM OF LIQUIDS.

T. O'CONOR SLOANE, PH.D.

A simple experiment, illustrative of the force of a jet of water, is illustrated in the cut accompanying this article. A capillary tube has a bulb blown upon it at about its center. If one end of this tube is immersed in water, and suction is applied to the other end by means of the mouth, the most natural thing to expect would be the filling of the bulb. But on trying the experiment it will be found that if any considerable degree of suction be employed, the bulb will fill very slowly and by a species of secondary action. The water will be drawn up toward the top of the tube, and will enter the bulb with considerable force, forming a little jet. This jet will enter the tube above the bulb, and will be drawn upward through it, leaving the bulb empty. A little air will be drawn up with the water, and a little of the fluid will fail to enter the upper tube. These two causes apparently, but strictly speaking only the first one, will gradually fill the bulb.

Instead of directly aspirating, the apparatus may better be arranged as shown in the cut. The exhaustion is produced within a bottle, and this receives the water delivered by the tube. The bottle is closed with a tightly fitting rubber cork, perforated for the passage of both tubes. Thus arranged, the experimenter can better observe the effects of the exhaustion. The appearance of the smooth, cylindrical thread of water as it crosses the bulb is quite interesting. In the bottle also a jet is produced, but, owing to the air carried up with the water composing it, this jet is not so smooth and regular as the lower one.

It will be noticed that the capillary tube is provided with a funnel at one end. This is for the purpose of reversing the experiment. The bottle is placed below, and the suction tube drawn up until its lower end is nearly even with the surface of the cork. Water may now be poured into the funnel, and suction may be applied. The water forms the thread, just as before. If the supply to the funnel is kept up, the bulb remains empty, or partially so, for some time.

Its action in gradually filling the bulb by producing exhaustion is due to the fact that the jet forms a *trompe*, or water air pump, similar to the Geissler mercury pump or the Bunsen water pump. Both of these are used for producing vacua on a similar principle, air being carried away by a moving column of water, with which it is mixed.

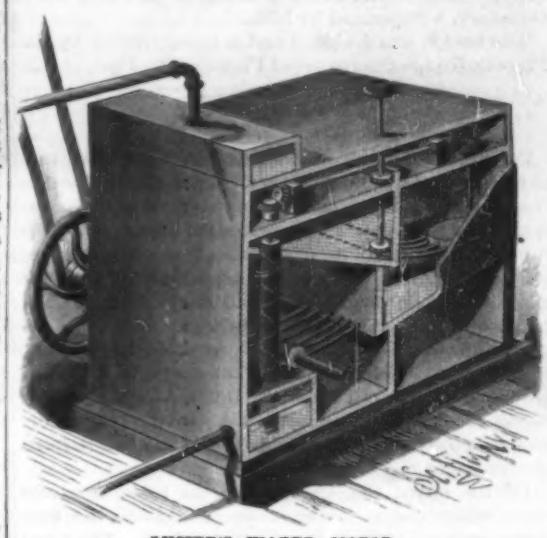
An Acid-proof Bronze.

Mr. P. Reitz has devised a bronze composition which is not attackable by acids and alkalies. This alloy is adapted for use in all those cases where recourse is had to ebonite, porcelain, and other materials, which, while proof against acids, are exposed to wear, and are for the most part very costly. The alloy consists of a mixture of copper, lead, zinc, and antimony, and consequently of materials already employed in the composition of bronzes; and so it is to the judicious proportions of the mixture that Mr. Reitz attributes the new results obtained. He melts in a crucible 15 parts of copper, 2·34 of zinc, 1·82 of lead, and 1 of antimony.

This alloy is worked as usual. It is adapted for use in the manufacture of chemical products, for washing apparatus and various utensils.—*Revue Industrielle.*

WATER MOTOR.

In this motor, which is the invention of Mr. Antoine Lucier, of Winnipeg, Manitoba, Canada, a portion of the water is used over and over, with some additions from time to time, the parts being so arranged that the power produced can be utilized in the running of machinery. The main inclosing case is formed with an upper tank having an inclined bottom, an oppositely arranged tank below the upper one, and also having an inclined bottom, and a third tank at the bottom; the latter tank having an outlet for the escape of a portion of its water, the rest being returned to the top



LUCIER'S WATER MOTOR.

tank. One or more vertical tubes extend from the lower to above the water level of the top tank, and in each tube is arranged an Archimedean screw. At the top of each screw shaft is a bevel gear, meshing with a similar gear on a horizontal shaft, upon the other end of which is another gear engaged by a gear carried by a vertical shaft driven by a water wheel contained in a case fed by tubes leading from the lower part of the upper tank. The central tank supplies water to other wheels arranged just above the bottom tank, these wheels being connected to drive a horizontal shaft, from which the power is obtained. Above the case is a supply tank, fed in any suitable manner. In operation, the water from the top tank will operate the wheels connected with it, and, through the gearing, will impart a rotary motion to the screws, which will raise a portion of the water from the bottom to the top tank. The water then flows from the middle tank to the other set of wheels, and drives the power shaft. The water then runs into the lower tank, from which a portion is

THE MOMENTUM OF LIQUIDS.

discharged. By means of gates, the supply of water passing from the upper to the middle tank, or from the middle to the lower tank, can be regulated.

IN the *Boston Medical and Surgical Journal* of March 10, Dr. J. S. Howe calls attention to the poisonous effects of the common ox eye daisy (*Chrysanthemum leucanthemum, L.*) upon certain persons, chiefly those who suffer similarly from the poisonous effects of *Rhus toxicodendron*. The symptoms produced are those that are included in the description of dermatitis vinenata, and consist in troublesome heat and itching, and the formation of vesicles, followed by desquamation of the cuticle.

NEWARK BAY DRAW BRIDGE.

(*Continued from first page.*)

of the two spans when the bridge is open. The bridge rests and turns upon cone wheels mounted upon the outer ends of rods radiating from the pivot. The outer ends of these rods are placed lower than their inner ends, so as to bring the upper surfaces of the wheels horizontal. This construction obviates the necessity of making two coned tracks for the wheels to run between. Concentric with and just outside of the wheels is a rack, with which engages a pinion operated by the engine to turn the draw. The draw is also provided with suitable gearing, so that it could, if necessary, be operated by hand.

The bridge was designed and is being erected by the Phœnix Bridge Company, of Phœnixville, Pa.

Varnish Resins.

BY P. LUND SIMMONDS.

The number of substances suitable for coarse varnishes has lately become very numerous in Europe. Common resin is now purified by a patent process consisting of distillation with superheated steam, by which it is obtained nearly transparent and colorless as glass. Resins suited, however, for the preparation of the finer descriptions of varnish are still very limited. All plants produce, indeed, resins in a greater or less degree, but the trees which produce them in sufficient quantities to be of commercial value are to be found principally in South America, India, Africa, and New Zealand. These belong principally to the pine tribe, the *Dipteraceæ* (only found in India and the Eastern Archipelago) and the *Leguminosæ*.

Of the latter, the *Hymenæa* seem to be the trees from which the resins most nearly akin to the true hard, or fossil, copals are mostly derived. The copal of Africa and the dammar of New Zealand (known in commerce as kowrie gum) are the best known and most esteemed.

The word varnish covers a very wide field, as the term, in its fullest sense, can embrace all the thousand and one prepartions compounded for as many different purposes. An essential quality of varnish is that it must harden without losing its transparency, as it must not change the colors it is intended to preserve. It must exclude the action of air, because wood and metals are varnished to protect them from rust and decay. It must also be waterproof, else the effect of the varnish would not be permanent. And a point of primary importance is that it must possess durability. New uses are constantly being found for varnish, by which it embellishes the article to which it is applied, affording satisfaction to the buyer and profit to the manufacturer. A few notes on the chief varnish resins may therefore be acceptable.

East Indian dammar is the name applied by varnish makers to the resin of *Dammara orientalis*, imported chiefly from Singapore, which is straw colored, or, like pale amber, very clear or transparent. It is easily and entirely soluble in benzole, ether, or chloroform, less rapidly so in turpentine, forming a clear, nearly colorless varnish, which dries rapidly on exposure to the air. Dammar comes principally from the Lampong islands and Sumatra, and the yearly receipts may be given at about 32,000 cwt.

This resin is produced by many kinds of trees in the State of Perak. The principal are *Dammar mata kutching*, *D. Meranti*, *D. Lant*, *D. Degon*, and *Dammar Balk*. It is the sap which exudes spontaneously, and being exposed to the air acquires a flinty hardness, from which the epithet batu, or stone, is given, to distinguish it from the softer resins. The dammar is found either in large masses at the foot of trees which yield it, or floating in rivers, drifted to them by the floods of the rainy season. The natives apply it to most of the uses to which we put tar, pitch, and resin. Most of the family of *Dipterocarpeæ* yield balsamic, resinous juices, those of the genus *Dipterocarpus* the wood oils, and of *Vateria* indurated dammar. The natural order abounds in Sumatra, Java, and Borneo, which are the chief sources of the dammar of commerce. In Borneo, dammar is generally found in the ground below the trees, but may occasionally be seen in huge masses, not unlike icicles, hanging from the sides of the trees. A single piece weighing 6 cwt. has been found on one tree, but necessarily these large masses get broken in collection. The value of the dammar found in the Sandakan district, North Borneo, is rarely over 10s. per cwt. Further to the north much better sorts are found. The dammar mata kutching (or cat's eye), of Palaman, brings £3 per cwt.

Of resins, chiefly dammars, we import 20,000 cwt. from Singapore and 6,000 cwt. from Java.

Two or three species of dammars are met with in British India, but are of no great commercial value. *Canarium strictum* is known in Malabar under the name of the black dammar tree, in contradistinction to the *Vateria indica*, known as the white dammar tree.

The Sal tree (*Shorea robusta*) furnishes also a dammar which dissolves much more freely and speedily in benzole than in spirits of turpentine. This resin is usually of a pale, creamy color, nearly opaque. *Shorea sericea* yields a kind of dammar which closely resembles the Indian kind.

Hopea odorata, of Burmah and Pegu, yields the rock dammar of commerce, a yellow resin which dissolves readily. The trunk of *Hopea Mingarawan* furnishes a white dammar of a superior quality. The resin yielded by *Hopea Micrantha* in Borneo, Sumatra, and Malacca is not so good, but that obtained from Belambang is much sought after for the luster it gives. This resin is of a yellowish color, and exudes in large lumps from the trunk and branches. It is soluble in turpentine or benzole, and forms a clear, limpid varnish.

The Kauri gum of commerce is the produce of *Dammara Australis*, a coniferous tree which occurs only in the north island of New Zealand, over a large area of land which has been exhausted by forests in past ages, and is now barren. The turpentine that has exuded from the dead trees is found at a depth of from 2 feet to 3 feet. The export of this fossil resin has been steadily increasing the last thirty years. In 1855 only 355 tons were shipped, while in 1883, 1884, and 1885 the annual shipments were over 6,000 tons, valued at £320,000. We received in 1885, 81,000 cwt., valued at £254,000. This fossil resin is often found in immense masses, larger than those of any other known resin. Fine blocks were shown in the New Zealand court at South Kensington last year, as well as large collections of trade samples of the different commercial varieties.

Copal of Zanzibar.—This, sometimes called Indian anime, has been found to be the produce of *Hymenæa Mosambicensis*, or *Trachylobium Mosambicense*. The South American species, *Hymenæa courbaril*, also yield a good deal of resin.

The true, or ripe, copal is the product of vast extinct forests overthrown in former ages. The export from Zanzibar averages about 1,000,000 pounds annually. The raw, or true, copal is called chackaze, corrupted by the Zanzibar merchant to jackass copal. Copal, it may be remarked, is the Mexican generic name for all resins.

Manila copal derives its name from the port from which it is shipped. There are two varieties, known as hard and soft manila; the hard resembles kowrie in appearance, but is inferior in quality; the soft is a pale yellow kind resembling dammar.

From *Hymenæa courbaril* the soft resin known in commerce as American copal is obtained. The tree is very extensively diffused over the West Indies, British Guiana, Venezuela, Mexico, and in almost all the provinces of Brazil, though some other species of *Hymenæa* probably furnish the resin. It is found in many localities in a semi-fossil state, and is obtained by digging in the vicinity of the roots of the tree. The masses seem to have the appearance of a stalagmitic formation arising from exudations from the branches of the tree dropping in the soil below.

Guibourtea copallifera is the principal, if not the sole, source of the copal resin of Sierra Leone. All the resin exported under the name of West African copal may be looked upon as a fossil resin, produced in times past by trees which, at present, are extinct, or exist only in a dwarfed posterity.

The origin of the kind of copal known as Angola is at present undetermined. Considerable quantities of copal are washed down during the rainy season from the slopes of the mountains. The natives subject the copal to a rude washing in lixiviated ashes, whereby the outer crust and its impurities are partly removed. It has, on arrival, to be further cleansed for the trade with extreme care, and without the use of acids, which are very detrimental to varnishes in causing them to run "pinholey."

The flat Angola copal is sometimes called red anime, as it somewhat resembles it in appearance and quality. It is principally sent from here to Europe and America. The rounded water nodules, known as "pebble copal," assume this form from the abrasion consequent on their being washed down by the rapid mountain currents, from the beds of which they are obtained.

The anime of commerce is a resin of great value to the varnish maker, but it is now largely replaced by copal. The best is obtained from Zanzibar, and is derived originally from *Trachylobium Mosambicense*. The finer qualities come from the northern districts of Wande. The imports are never very large, seldom amounting to 3,000 cwt. Of copal, the imports occasionally reach 20,000 cwt., but the imports from West Africa are only about 7,000 cwt. Of dammar the imports range from 3,000 to 7,000 cwt., and of kowrie gum, 70,000 cwt. to 80,000 cwt. annually.—*Journal of the Society of Arts.*

Specific Gravity of Beeswax.*

Herr Dieterich has of late examined into the real specific gravity of beeswax, the different observers giving often widely varying figures. He found that this was due to the different ways in which the "floating" test in more or less diluted alcohol was conducted. The best dilutions are: 0·960, 0·961, 0·962, 0·964, 0·965, 0·966, 0·967.

There are three ways in which the test is applied:

1. A piece of wax is chipped off, cleaned as much as possible from all fragments, and allowed to float. The specific gravity of the diluted alcohol in which the wax floats in the middle (neither on the surface nor at the bottom) is the true specific gravity of the wax.

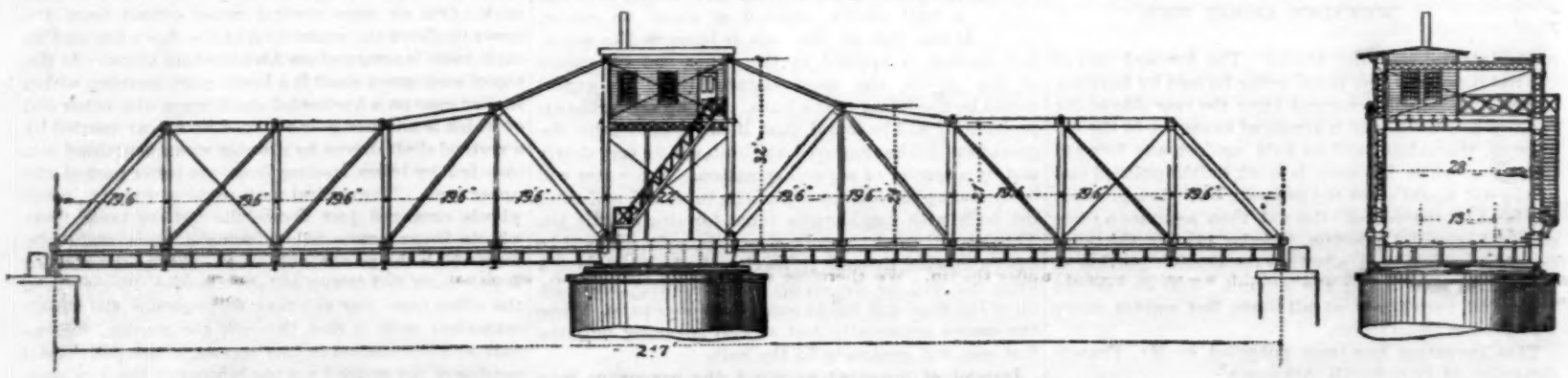
2. A piece of wax is kneaded in order to make it homogeneous and exclude all air, and allowed to float.

3. Hager's "pearl" method. Heat a piece of beeswax over a small alcohol flame till a drop of melted wax is formed, and allow it to fall into strong alcohol, keeping the wax as near over the surface as possible. Form in this way a dozen "pearls," put them on blotting paper, and let them dry at ordinary temperature for twenty-four hours (because recently made "pearls" are too bulky, and therefore give a too low specific gravity); then allow them to float in the diluted alcohol.

The following figures will show the difference in specific gravity according to the treatment of the same wax:

Chipped piece	0·963
Kneading one minute	0·957
Kneading five minutes	0·963
Recently made pearls	0·961
Pearls after twenty-four hours	0·964

Dieterich finds after several years' experience with very large quantities of beeswax that the specific gravity is between 0·963 and 0·966.



NEWARK BAY DRAW BRIDGE—SIDE ELEVATION AND CROSS SECTION OF NEW DRAW BRIDGE.

Ladislas Adolphe Gaiffe.

The well known electrician Ladislas Adolphe Gaiffe died on April 9, at the age of fifty-five years.

The number of new apparatus devised or manufactured by him is very large, and his medical electrical instruments are known throughout the world. He was one of the first, if, indeed, not the first, to recognize the advantages that could be derived from nickel applied electrolytically to oxidizable metals. What he called "nickelure," and what his imitators style "nickelage," has become an extensive industry.

Mr. Gaiffe was an able co-worker with many eminent scientists, and his fertile brain suggested many valuable improvements to apparatus intrusted by inventors to him to be manufactured. He was made Chevalier of the Legion of Honor at the time of the Exhibition of Electricity at Paris, in 1881.

* From *Pharm. Zeitung.* Reprinted from the *Pharmaceutical Record*, February 15.

Correspondence.

To Prevent Mustiness.

To the Editor of the Scientific American:

In your last issue I find an inquiry how to dispel the mouldy smell from a room. I find by experience that there is nothing equal to indirect heating system to make a room smell pure, either furnace heating or indirect steam heating. The pure dry air it furnishes will make ventilation in every part of the room good.

J. A.

Cairo, Ill., May 4, 1887.

Bellite—A Correction by Prof. Bolton.

To the Editor of the Scientific American:

Permit me to call your attention to an unfortunate typographical error in the SCIENTIFIC AMERICAN for May 14. In the article on bellite (page 303) benzene is unfortunately spelled benzine throughout. The necessity of recognizing the difference between benzene (synonym of benzol) and benzine is well known to you, but I hope you will give your readers the benefit of a correction in an early number.

H. CARRINGTON BOLTON.

Trinity College, Hartford, Conn.

A Shower of Worms.

To the Editor of the Scientific American:

I suppose the fact that small animals are drawn up into the clouds, and fall to the ground during storms, is very well established. I think the best evidence of this fact that I have ever seen was witnessed by my two brothers, with myself, to-day, April 25. As we were walking over a hill in this place where the snow had gone away recently, we came upon a drift by the side of a dry ridge of land, that was some four or five rods in length by two in width at the widest place. While crossing it, I noticed little holes melted in the snow an inch or two deep, at the bottom of which were angle worms. These were scattered over the drift promiscuously, and the worms had been there apparently a day or two, as they had melted their way into the snow an inch or more. From the situation of the drift, it is not possible that they could have been conveyed there by a stream of water, and it is not probable that they would crawl over the snow ten or fifteen feet to the center of the drift, where it was two feet deep, even if they had been in the dry ridge over which the snow drifted. Last Saturday night we were visited with a hard shower, which carried off our snow very fast, and in my opinion deposited the angle worms where we found them on the snow.

DANA J. BUGBEE.

North Pomfret, Vt., April 25, 1887.

Management of Rotary Boilers.

To the Editor of the Scientific American:

Another rotary boiler explosion makes me hurry to give you my idea of what may have something to do with these frightful mysteries. If I want to boil in a rotary boiler stock difficult to subdue, or having something in it I want to kill, I rely on heat more than pressure, and having sixty pounds on generating boiler, I find I can get over 300 degrees in the rotary, without raising the pressure in her above thirty-five pounds. This is done by using the water in the rotary eight inches above the center, so that the steam on going into each end will strike into the water, not over it. When the steam strikes over the water, although the boiler is revolving one turn in two minutes, it keeps over, and don't heat the revolving mass the same. Too much water would give pressure with little heat.

On starting the boiler to revolve, I open an inch valve, the steam divides, and goes into both ends. Three and a half hours gives twenty pounds pressure. I close the valve, so there is three quarters of a turn open. The pressure will be thirty-five in eight hours from start. When rotary is stopped, steam blown off, it is very difficult and dangerous, having to force the manheads down with lever pressure. I have seen the men have to drop the lever and get away in a hurry, the boiling, foaming mass blowing all over the room. I have let the boiler stand an hour before turning down to drain, and still boiling and foaming, showing the intense heat, and this is my impression: When so hot must be making steam, and if so, would do it very suddenly, and gauges or regulators would be useless, as all the inlets would be stopped with boiling stock. I never could get anything like this heat in any other way than by striking the steam into the water, and using the steam in that way. I boil all my stock this way, but tend the pressure myself, and think I could blow her up if I wanted to. WM. CHALMERS.

Camden, N. J., May 2, 1887.

Myriads of Cotton Worms.

The number of cotton caterpillars in the Pedee Swamp is so great that, on May 18, a mail train passing over the Pedee River trestle was brought to a standstill by thousands of these worms crushed on the rails, causing the wheels to slip.

Many Items of Interest.

Taking the iron trade over the country at large, says the *Railway Review*, the volume of business has been moderate. Here and there prices have weakened, as, for instance, in the inferior grades of pig iron, old rails, and, under certain conditions, steel rails. Contracts have been placed for steel rails at $38 at mill, though in non-competitive territory $40 to $41 is asked and paid for smaller lots for summer delivery.

Contracts have been closed for about 30,000 tons of foreign rails. Within the past week several thousand tons of bridge iron have been contracted for. Manufacturers of plate iron are about closing business for various kinds of iron and steel plates. The actual market conditions are favorable to strong prices and a steady demand. The furnace capacity is increasing, and for good brands prices are firm. Manufactured iron is rather slow, while nails are more active. Inquiries have been restricted to the actual requirements in most cases. Consumers are not quite as willing to enter into future contracts at this date as they were a few weeks ago. A conservative feeling controls the trade, while prices are not likely to decline, on account of the increased cost to manufacturers, and an advance is improbable.

During the winter, the frost and rains make sad havoc with tin roofs, and in our northern latitude the tinman is full of repair orders in the spring of the year. According to a writer in the *American Artisan* who is a practical roofer, the upright flashings on the north and east sides of the roof are the places most likely to be affected by the elements. To solder these broken seams by the piling on process takes much time and solder, the chances being that next year they will have to be done over again.

To solder seams properly, the old solder should be melted off, the old tin nicely retinned, and strips of tin soldered over the old seam. The edges of the strips can be bent slightly in the locker, so they will not spring up while being soldered.

The brick fire walls are apt to become sadly out of repair, and while it may not be the tinner's business to apply the mortar or cement to their ancient joints, he will be blamed if the water should find its way in under the tin. We therefore suggest that the tinman should inform the owner of the defect, if he is not willing to make the repairs himself.

To make an ink, black at the time of writing, but which shall disappear after a short time, boil nut galls in aqua vitæ, put Roman vitriol and sal ammoniac to it, and when cold dissolve a little gum in it. Writing done with this ink will vanish in twenty-four hours.

Every time we open a SCIENTIFIC AMERICAN, says a contemporary, we wonder how many boys are enjoying its bright, attractive pages, filled with matter as interesting and useful to a bright boy as to his father, for whom it was specially written.

There is no tree that is so sure to grow without any care as the willow. A twig from a branch of the tree stuck into the moist earth, and the labor is completed. An article in the *Konigsberger Land und Forstwirthschafliche Zeitung* recommends the cultivation of willow trees, not only from an economical and industrial point of view, but also for hygienic purposes. They are especially useful where the drinking water is taken from fountains or natural wells, and still more where there are morasses and meadows; for in the vicinity of willow trees water is always clear and pure. Let those who doubt this fact place a piece of willow which has not yet begun to strike, into a bottle of water, and place this with another bottle containing water only in a warm room for eight days; in the first bottle will be found shoots and rootlets in clear water, while the other bottle will contain putrefying water. Holland is covered with willows, and their dam works are made stronger by the network formed by the roots.

The Czar of Russia, at his Winter Palace on the banks of the Neva, St. Petersburg, possesses what is probably the largest permanent installation of electric light ever placed in a single building. The palace itself is illuminated by 12,000 incandescent lamps, while 56 powerful arcs light up the front and the various court yards. The machine room contains eight engines, capable of developing 2,500 horse power; the dynamos, including reserve machines, are 26 in number.

From an abstract from the report of the Commissioners of Education for the years 1884 and 1885, just published, instances are mentioned of the New York Trade Schools, which have been in operation four years, and the Baltimore and Ohio Technological School, established by the Baltimore and Ohio Railroad Company for the promotion of a higher course of instruction for the apprentices of the service. Cookery, which is included in the course of elementary instruction in several foreign countries, has thus far found no place in the common schools of the United States.

Work, says one who is accustomed to it, is the true philosopher's stone, whether you handle a pick or a pen, a wheelbarrow or a set of books, digging, ditching, or editing a newspaper.

The *Age of Steel*, believing in electricity as the future motive power for street cars, sums up the advantages of it over horses as follows: 1. Not so much real estate is required for the station as for the stable; nor is the location or the character of the building so much a matter of importance and cost with the former as with the latter. 2. The annual loss in efficiency of say one-fifth of the live stock employed, whereby twenty animals out of every hundred are sold for a song, is avoided. 3. The cost of attendance is very materially reduced. 4. There is no liability to epizooty, costly in respect of both live stock and traffic. 5. There is no likelihood of the motive power "eating its head off" during a strike or while idleness is enforced by any one of a number of causes. 6. The efficiency of the horse in extremely hot or cold weather is at its lowest, though it should be at its highest—which is another and the final point in favor of electricity, if we leave speed out of account.

Some experiments on the resistance offered by a bank of snow to a rifle bullet were made recently at Ottawa, by Col. White, which were most interesting. It was found that the Martini bullets fired into a bank of well packed snow were completely spent after traversing a distance of not more than four feet. Snider bullets, in hard packed snow mixed with ice, but not hard enough to prevent digging into it with a sheet iron shovel, did not penetrate more than about four feet; in perfectly dry snow, packed by natural drift, but capable of being easily crushed in the hand, a bullet penetrated about four feet, and in loose drifted dry snow less than seven feet, though fired from points only 20 or 30 yards distant.

A. Birmingham (Conn.) electrician has a new rat trap, which, it is said, works admirably. He attaches a piece of meat to one pole of a dynamo machine, which can only be reached by the rat by standing on a plate, which serves as the other pole. Report says that no rat has yet got the meat, but many have reached for it, and the inventor is rewarded for his ingenuity with a large collection of dead rats.

Instead of either ordinary inhumation, cremation, or embalming, one Kergovatz proposes to replace these methods by galvanoplasty. After having covered the subject with a layer of plumbago, it is immersed in a bath. Copper being expensive, zinc may be substituted for those who are poor. On the other hand, gold or silver is used for the rich. It has been suggested to prolong the bath, and thus have our friends transformed into statues of natural size.

During the early part of these evenings, when the sky is clear, Jupiter can be seen beaming in the eastern sky and Venus blazing in the west. They are the two brightest of our stellar luminaries, not often seen together to such advantage.

Experiments with Static Electricity.

According to the London *Electrician*, the following interesting experiments were described by Mr. Boys at a recent meeting of the Physical Society:

"If sealing wax or any similar sticky substance be melted in a cup and put upon the conductor of an electrical machine, as in one of the old fashioned experiments, it will begin to throw out threads in an extraordinary way; the fibers are large when the resinous matter is very hot, and each fiber shoots out as a cylinder with remarkable speed, then breaks into beads. These minute beads can be made to patter against a drum head, and make a noise upon it like falling rain. The cup containing the melted wax should be inclined from the operator, and from the electrical machine before the latter is worked, or both will be covered with the most invisible sticky web imaginable. A cup of burnt India rubber tubing so treated sends out almost invisible filaments. Canada balsam is the perfection of a material for producing sticky threads. When a candle is held near a cup throwing out such electrical filaments, they shoot into the flame and sometimes cover the candle; sometimes they will stop as they approach the flame, then turn back and go into the cup from which they started, in consequence of discharging their electricity into the flame. In a few minutes, miles of these sticky threads can be made, and, as they break into beads, the method affords a ready means of powdering such of these substances as are not easily pulverized in any ordinary way."

ATTRACTION PRODUCED BY JETS OF STEAM OR AIR.

In a recent number* we described a few of the remarkable experiments of Mr. Charles Weyher on aerial vortices and revolving spheres. Among those that we passed over in silence, there is one which is of a nature to especially interest the friends of physics without apparatus, since it can be easily repeated by any one, with the aid of a few easily procured objects. It relates to the attraction produced by a jet of air, steam, or any fluid whatever. To the left of Fig. 1 may be seen the nozzle of a blowpipe, from whence is escaping a jet of steam. This jet holds captive a small ball of cork and a rubber balloon inflated with air, which have been placed in it. The nozzle may be inclined at an angle of 45° with the horizon without the balls falling. If the hand be placed in front of the balloon, the two spheres will approach the nozzle and each other. The densest sphere will be in equilibrium nearest the nozzle.

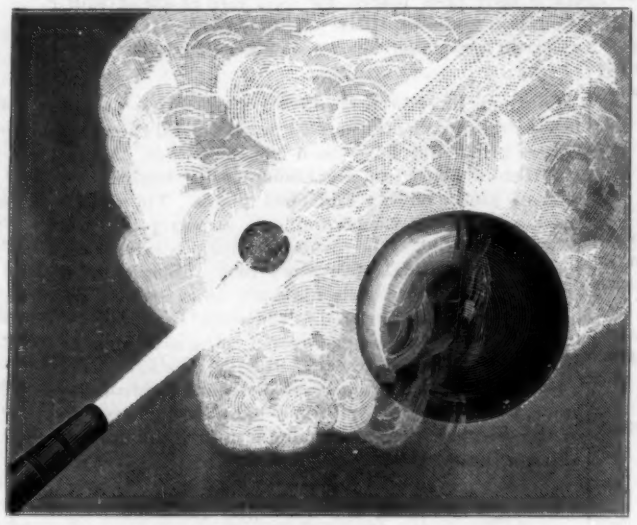


Fig. 1.—A CORK BALL AND RUBBER BALLOON SUSPENDED IN A JET OF STEAM.

Now for some analogous experiments in physics without apparatus. The first one that we shall describe was communicated by Mr. Roy de Pierrefitte. It can be easily performed with a little application. As spherical a pea as possible is selected, and, if dry, is allowed to soak for a while in water, in order to soften it, so that a pin can be passed through its center without splitting it. This done, we take a clay pipe stem, about two inches in length, and place the pea upon one of its extremities in such a way that one of the ends of the pin shall enter the aperture, and hold the pea in position. Putting the other extremity of the stem between the lips, and throwing the head back into a horizontal position, we begin to blow gently, and at first slowly. The pea is lifted, and, when we begin to blow with more force and

Fig. 2.—A PEA HELD IN A JET OF AIR.

with regularity, will rise and be held in the jet of air, entirely isolated, and will revolve whenever the pin receives a thrust from the air (Fig. 2).

Egg shells placed upon a jet of water are held thereon in the same way.

*SUPPLEMENT, No. 568, p. 9083.

The second experiment was communicated to us by Mr. Leon Couratier, a student at Paris.

A metallic pen holder, closed at one of its extremities, is taken, and at about half an inch from this closed end a circular aperture is made. Putting the open extremity of the pen holder into the mouth, we blow in such a way as to form a regular jet of air, which makes its exit through the orifice in the upper part of the cylinder. If a small ball made of bread crumbs be placed in the jet, it will be held in equilibrium, as shown in Fig. 3, and will remain thus as long as the flow of air continues. The ball should be as spherical as possible, and its size will vary with the density of the material of which it is composed and with the diameter of the orifice.

Analogous experiments may be easily performed in a more perfect manner with a fan blower or a gasometer. It is sufficient to produce a regular and rapid flow of air or steam at the extremity of a nozzle.—*La Nature.*

IMPROVED STEAM ROAD ROLLER.

In the self-propelling machine which we herewith illustrate, the material is so distributed as to facilitate the turning of corners and easy management of machine under all circumstances, and to give the drivers the adhesion necessary to overcome all ordinary obstructions and grades of street. With this end in view, the rear drivers and the front roller or steering wheel are as large in diameter as good design would permit. It is evident that small rolls are apt to work mischief, and that weight on the front drum in excess of its proportional diameter would have a tendency to push and crowd the material instead of mounting it. In this machine, two-thirds of the total weight is transmitted through the rear rolls, this having been found to produce the best results. The face of each roll measures twenty-four inches.

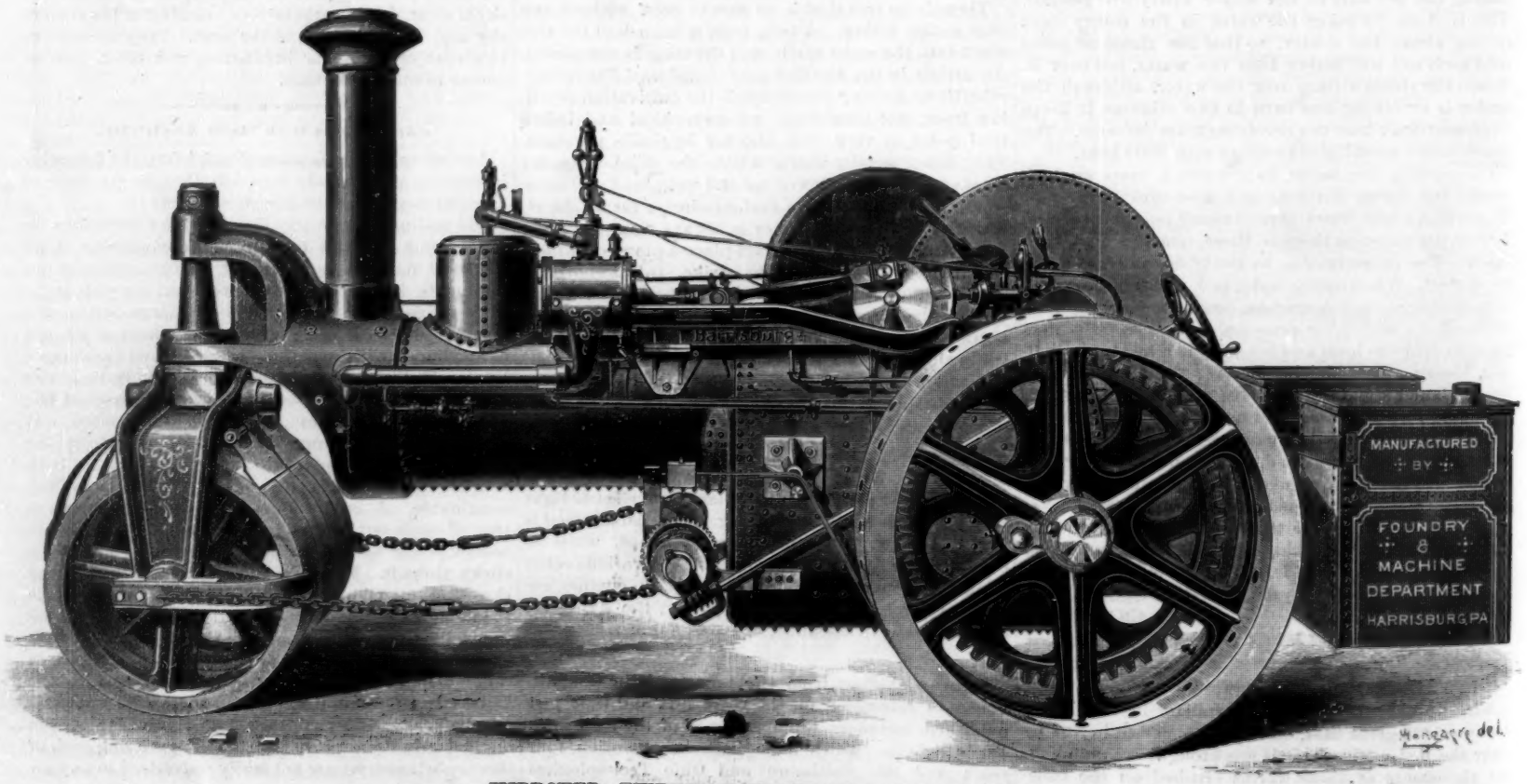
The forward wheel is divided into four sections, so that it will turn without digging up the road, and the width of this wheel is equal to the distance between the two rear ones. The drum has a universal movement, and readily adapts itself to any unevenness of road surface without straining any part. The boiler is made of extra heavy steel plate, double riveted, with water bottom type of fire box. The axles, countershaft, and gearing are very heavy. The engine cylinder is provided with a steam jacket, and the shaft, piston and valve rods are of steel. The reversing gear is simple and reliable. The construction of the tank is shown in the engraving; this form of tank admits of easy access to the foot board and fire door, and leaves a direct communication with the ash pit. The engine can be readily disconnected from the propelling gear, and can then be used for driving stone breaker and other machinery. Thus, when the roller is not required on the streets, it can be used as an ordinary engine. The engine is equipped with pump, locomotive inspirator, governor, whistle, and all other necessary auxiliaries. The boilers are all covered with wood lagging and Russia sheet iron jacket, not shown in the cut. This type of roller is made in sizes from 10 to 20 ton, and has many marked improvements which, upon examination, will be apparent to those conversant with the subject. The United States Commissioners at Washington, D. C., have just placed an order for a 10-ton roller with this company, to be used in the District of Columbia.

All further information concerning this roller will be furnished by the Foundry and Machine Department (Harrisburg Car Manufacturing Company), of Harrisburg, Pa.

PACIFIC STEAM NAVIGATION.—A line of steamers to Japan and China, running in connection with the Canadian Pacific Railway, will soon be in operation.

Fig. 3.—A BALL HELD IN A JET OF AIR.

Three Cunard steamers have been obtained and fitted with triple compound engines, guaranteed to attain a speed of 14 knots per hour. The Parthia will leave Hong Kong early in May, as the first of the line. Stoppages will be made at Hiogo and Yokohama, Japan.



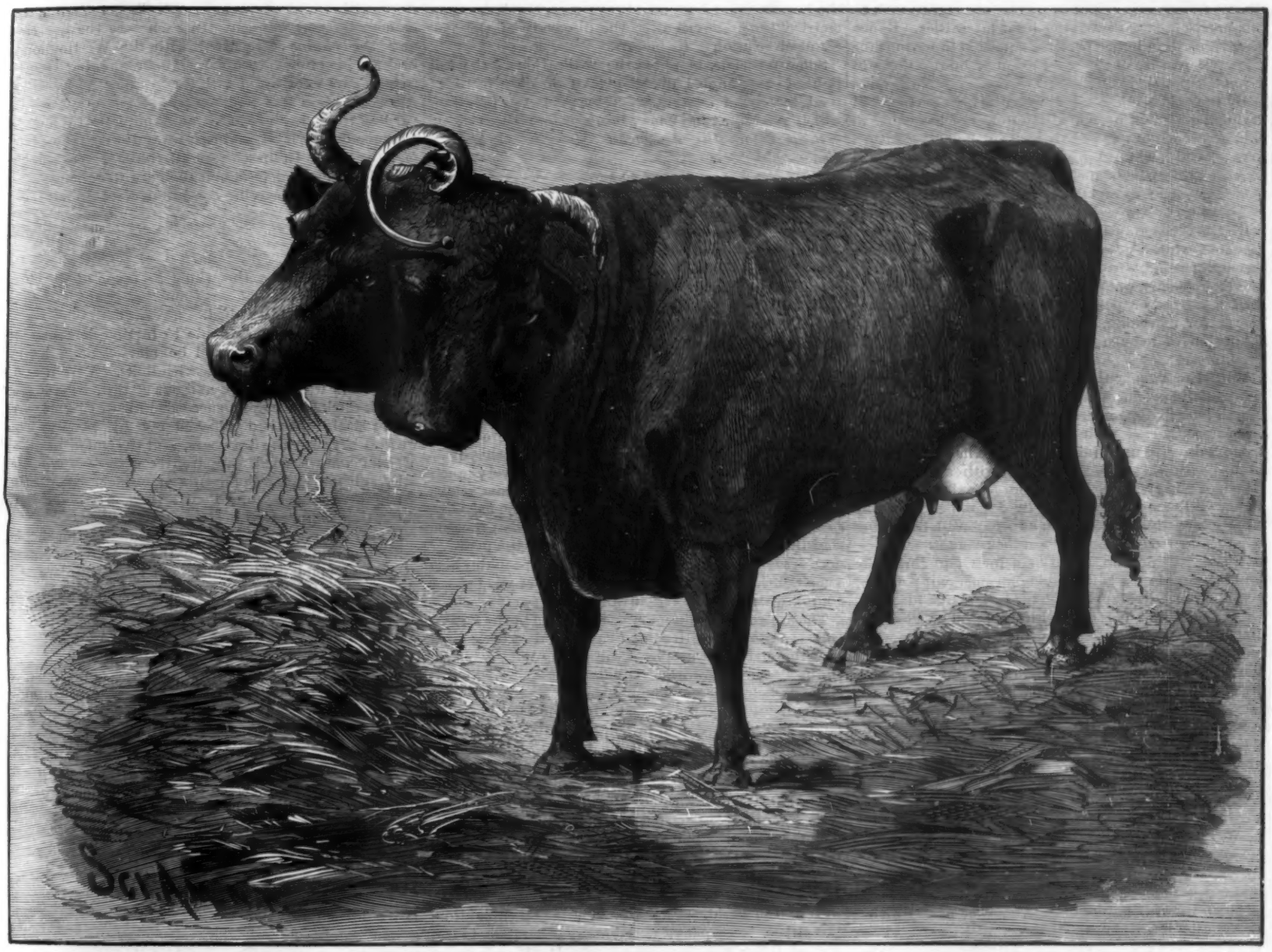
IMPROVED TWENTY-TON STEAM ROAD ROLLER.

THE TWO HEADED COW.

We present a sketch from life of the two headed cow that has been exhibited in this city and elsewhere with one of the leading circuses. The animal, except as regards its cranial peculiarity, is of normal appearance. It is well kept, and has a well developed body. The left head, the one nearest the front of the picture, is, as regards its external function, inferior to the other. It eats and drinks with the right hand mouth, having full command of its jaw. The jaw of the other head has hardly any power of motion, as it is embedded in the neck. It has three good eyes, and but for an accident, when the vehicle containing it was upset by an elephant, would possess four. The same occurrence broke one of its central horns. Although the left head is comparatively passive, yet under certain circumstances, as when the animal is eating, the mouth belonging to that head emits saliva. Although it cannot eat, this mouth can "water," as the epicures say. In the center of the forehead of the right head is a deep depression that does not appear in the left head. This would seem to indicate a deficiency in development of the brain on that side. But naturally all speculation on the inner structure cannot well pass the limits of conjecture until a post mortem examination can be had. The bony front in the region of the bases of the horns is continuous apparently for both sides.

For about one hundred years the subject of animal and human monstrosities has been systematically studied. Goethe remarked that "it is in her monsters that nature reveals to us her secrets." The elder Geoffroy St. Hilaire, the contemporary of Hauy the great mineralogist, and of Cuvier, whom indeed he antedated in the acquisition of renown, formed an elaborate classification of these abnormal growths. He gave the science a name, "teratology." His work, "Histoire des Anomalies," etc., was published in Paris, 1832–36. It is in three octavo volumes. He endeavors to bring the varieties of monsters into a sort of Linnean classification, using the divisions of classes, orders, tribes, families, and genera. Thus this cow would come within his second class, and in the second order, the *parasitaires*, of that class.

Except for its cranial peculiarities, this cow would probably be found perfectly organized; other monsters having repeatedly proved free from other than the local deformities or weaknesses. Among human monsters, the famous Siamese twins may be cited as an instance of this fact. In spite of their deformation, they lived in good health to the age of 63. They were married, and each had several children, who were free from deformity. It is very rare that true monstrosity is transmitted as an hereditary quality. It is also noticed that among animals, monsters predominate in the female sex.



THE TWO HEADED COW.

Vibrations of the Telephone Diaphragm.

M. E. Mercadier has recently contributed the results of some additional experiments on this subject to the *Academie des Sciences* of Paris. He distinguishes two classes of vibrations in the plate. One is molecular, independent of the form or dimensions of the diaphragm, and reproductive of all sounds. This he calls *pantelephonic* vibration. The other class of vibrations, affect the mass of the plate taken as a whole, depending on its form, elasticity, and structure. This vibration corresponds to the normal note of the plate and to its harmonics. The latter class is injurious as regards the action of the telephone. The experimenter arranged a telephone diaphragm so that it was held by three points of its circumference corresponding to the nodal lines of the first harmonic of a circular disk. The instrument with this modification in reproducing musical sounds produced only this particular note with any degree of strength, and the telephone was *monotelephonic* in action. But when the diaphragm was prevented from acting thus, by damping either with the fingers or by placing the ear directly against its surface, the molecular or *pantelephonic* vibration predominated, and all sounds were heard, including the first harmonic. The paper describing these experiments was presented at the *seance* of April 4, 1887.

Power of Sunshine.

Public Opinion condenses from the *Chautauquan* an interesting article by Charles Barnard, in which he shows that the great star which we call the sun is literally the stove that keeps the whole world warm. In conclusion, he gives the following facts, most of which are known to the readers of the SCIENTIFIC AMERICAN, but are none the less curious and interesting to the general reader.

Heat expands and cold contracts, and everything warmed by the sun expands under its gentle heat. Every rail on all our railroads expands and grows perceptibly longer in bright sunshine, and contracts and grows shorter whenever a cloud cuts off the heat or the earth in turning moves away from the sun. So it is found necessary to leave a little space between every rail, wherein it can stretch itself in hot summer days. Were all the rails pushed close together in laying the track, the first day of hot sunshine would pull the track to pieces, or render it so uneven that it could not be used. Every iron bridge stretches in the sunlight, and would tear itself to pieces were it not carefully adjusted for this expansion in the sun, and given a chance to freely move on its foundations whenever the warm fingers of the sunshine are laid upon it. Brooklyn bridge is in four distinct pieces, with plenty of room between to move, and it does move every day. In warm sunshine it is longer by several inches than on a cold night. The cables of the bridge are continuous, but the expansion caused by heat lengthens the cables, and they let the bridge sink two or three feet in the middle. Even a passing cloud, hiding the sun for a few moments, will cause the entire bridge to rise in the middle by cooling and contracting the cables. I have personally measured the movement of Brooklyn bridge on a hot summer's day, between bright sunshine and the shade caused by clouds, and have seen that it moved over one inch in less than two hours. In building the great bronze Liberty in New York harbor, the same thing had to be guarded against, and provision is made to allow the whole vast figure to move under the expansion caused by the heat of the sun. The movement, owing to the irregular surface of the statue, is not visible, as in the Brooklyn bridge, yet it is there. Even Bunker Hill monument, which is built wholly of stone, is distorted out of shape every day by the sun, though the movement cannot be proved except by certain experiments made for that purpose. What will finally become of our stellar stove no man can positively say. Yet, judging from what we know already, it is quite possible that it is burning out. When its fires finally die down, the end of our planet is at hand, and all life here will slowly, or suddenly perhaps, become extinct by freezing, and our planet will meet its end as a dead star swinging through the awful cold of the stellar spaces. People of fervid imagination have thought the world would come to an end in a general conflagration. It is much more likely our stellar stove will go out, and the world will calmly freeze up. Of the two methods of ending earthly history, the latter will be evidently the more comfortable.

Limit of Available Power in Great Telescopes.

BY G. D. HISCOX.

According to accredited formulæ, the minimum diameter of the optic pencil at its emergence from the eye piece of a telescope is equal to the diameter of the object glass divided by the magnifying power; and by inversion, the magnifying power equals the diameter of the object glass divided by the diameter of the emergent pencil.

As it is often desirable to observe nebulæ and clusters, as well as search for faint comets, under very low powers, for the purpose of obtaining a larger and more brilliant field, and for bringing out the fainter companions of double stars, the fact becomes important that in great telescopes an observer may only obtain the value of two-thirds, one-half, or even one-third of the total light-grasping power of the telescope. This failure comes from the disparity in the size of the pupil of the eye and the emergent pencil of light from low power eye pieces.

The eye aperture in different individuals varies from one-eighth inch to one-fourth inch in diameter under the same light intensities; and the pupil of a single individual may vary in diameter from one-eighth inch to one-fourth inch with varying light intensities. Hence there must be a larger personal equation to account for the discrepancies in the recognition of faint objects in large telescopes.

By the rule, a telescope of twelve inches aperture will have an emergent pencil, with a power of 100, equal to 0·12 of an inch or one-eighth inch in diameter; with a power of 50 it will equal one-fourth inch.

An eighteen inch aperture with power of 100 has a pencil 0·18 inch, or about 3-16 of an inch in diameter.

A power of 150 gives a one-eighth inch pencil, so that with the Chicago telescope a power of 100 is the lowest possible, while a power of 50 would shut out more than one-half the light from any ordinary pupil. But here the trouble only begins. A power of 100 with a field of half a degree, or possibly more, is a good working power for searching, and for bringing out the configuration of nebulæ by contrast with a dark background.

With the twenty-three inch Princeton telescope a power of 100 produces a pencil 0·23 inch, or nearly one-fourth inch in diameter, about the largest that can be compassed by eyes with large pupils, when the telescope is directed upon faint objects. The lowest power in use with this telescope is 158, with an emergent pencil of 0·15 of an inch, or about equal to the diameter of the ordinary pupil in daylight. Here the equation of the eye comes in as a factor determining what one person can see and another cannot.

In the Washington twenty-six inch equatorial the lowest power in use is 155, giving an emergent pencil of 0·17 of an inch in diameter. This is too large for many to compass, and it is only with the pupil of Professor Harkness, which is 0·22 of an inch in diameter when looking at a distant light, that assurance is had that the whole power of the telescope is made available with this magnification. With a power of 100 the pencil would be increased to 0·26 of an inch, placing its full power beyond the scope of the human eye. So with such a telescope 155 is the lowest power available for the delicate work of studying the fainter wisps and minute stars of the nebulæ.

The thirty-six inch telescope of the Lick Observatory will be somewhat crippled by this difficulty, unless some new form of eye piece is made to overcome it, for with a power of 100 the pencil will be 0·36 inch, or nearly three-eighths of an inch in diameter, making it impossible to use the leviathan for all that it is worth with low powers. A power of 200 with a pencil 0·18 of an inch in diameter will be the lowest that will give the full value of its light-grasping power to an ordinary pupil; the measurement of the latter ranging from 0·12 to 0·20 of an inch in diameter when in a normal condition. Now, 200 is an unsatisfactory power with which to view a nebula and comprehend its beauty and delicacy.

When we rise to the sphere of the great reflectors, we meet an insuperable stumbling block. A forty-eight inch reflector cannot use economically a power of less than 250; while the great seventy-two inch reflector of Lord Rosse is restricted with a power lower than 350, which produces a pencil of 0·20 of an inch diameter, the utmost capacity of the average eye; so that but few persons can compass the light-giving power of this great telescope even with this power, which is far too great for nebula work. With a power of 500 the pencil, 0·14 of an inch, just comes within the light-grasping power of the average eye.

With such an unwieldy instrument and great magnification, it is no wonder that stars are unsteady and seeing unsatisfactory, as has been often asserted; nor is it a wonder that the great reflector has done so little work, when a power of 300 produces an emergent pencil of 0·36 of an inch in diameter, and with such a power only one-fifth the light-giving power of that monster telescope can be utilized. The part thus shut out would naturally be the marginal cone, which gives the sharpest definition by producing the smallest star disk; leaving for the observer's gratification the poorest offering within the gift of so great and costly an instrument.

In celestial photography this difficulty is avoided, and this may account for the late photographic discoveries of faint objects by some of the large telescopes in France and England, the forty-eight inch reflectors of the Paris Observatory, and of Mr. Common in England, being now used for this purpose. The photographic plate utilizes the whole light of the largest emergent pencil, and with the quick process will no doubt realize large and satisfactory results in the near future.

The method of overcoming this optical defect in the low powers of great telescopes is worthy of our best efforts, and its remedy may lie within the scope of mechanical optics; although in a slight correspondence with Professor Young on this subject, he casts some grave doubts on the possibility of its accomplishment, or the *dodgeability* of its geometrical considerations. I do not think that theoretical geometry is at fault for this suggestion, for it has always been found to swing into line in the face of mechanical facts; not that geometry is at fault or untrue, but that the human mind has not always recognized the geometrical bearing until after the discovery of the mechanical relation of its factors.

Some experiments upon the realization of the full light of wide-angled object glasses of short focus, as used for comet seekers, seem to point to a solution, which at a later time I may bring before the Society. —*Read before the American Astronomical Society, January* 10, 1887.

Patent Lessons from the Telephone Litigation.

In a letter to the *American Engineer*, Mr. John McClary Perkins writes as follows:

The discussions which have been going on before the people of the United States and before certain federal courts during the past few years, regarding the so-called Bell telephone patent of March 7, 1876, are now all closed, and five appealed cases are now under consideration by the United States Supreme Court, and the decision of this court may now be expected on any day. There is no possibility of a doubt even as to what the decision of the Supreme Court will be as far as the Bell patent of 1876 is concerned. It will be wholly wiped out so far as the telephone is concerned. There are so many conclusive reasons for this opinion that it is puerile to discuss the matter. Of course, very much comment, thought, and discussion will follow. The history of this so-called Bell telephone patent has been so very remarkable in the courts that it is probable that there will be no little discussion as to the pressing need of some change in the patent law, and probably also some radical change in the constitution of the federal courts, which alone have jurisdiction of patent suits.

The system of preliminary examination in the Patent Office is attended with so many evils and so little good that the first thing proposed will probably be a return to the system of granting patents as it existed in this country before 1836. Then a patent was granted to whomsoever asked for it—as it always has been in England—and the burden of proving the validity of his patent before the courts devolved upon the inventor. But this will be no hardship, nor will the burden of proving the validity of his patent before the courts be any greater than it now is.

At present a patent has no real value until it has been sustained by some federal court in a bona fide infringement suit. It will have only the same result by a return to the patent system as it existed in this country before 1836, and as it now exists in England and the rest of the world. All chance for fraud, corruption, favoritism, incompetency, and many other evils in the Patent Office will then be cut off. It will only be an illustration of the good old Democratic doctrine that the simplest government, that which has the least machinery and consequent friction, is always the best government.

As the outcome of the lessons which will be learned from these remarkable telephone trials in the federal courts during the past seven or eight years, the second probable conclusion will be that the tenure of judicial office by federal judges should be changed to a term of years instead of for life, as it is now fixed by the Constitution. Of course this will require an amendment to the Constitution. But that will require but a short time if the people are ripe for such a change in the tenure of federal judicial office. It is now partly published and known by the American people in regard to what painful and well grounded suspicions exist as to the doubtful manner in which the two first and principal decisions were obtained here in Boston in favor of the validity of the Bell patent of 1876. This should permanently settle the matter that no federal judge should ever again hold a life office, and be so far removed from the people as to be practically irresponsible to the people. In other words, to use the words of the Massachusetts Bill of Rights, this should be a government of laws and not of men.

These two changes are very important and radical ones. But I think that these will be the final conclusions of the American people—as the outcome of the Supreme Court decision invalidating the Bell patent of 1876. These changes will cause a fundamental change not only in the system of granting patents, but also in the administration of the patent law, and will be a vital improvement. Other subordinate changes for the better will follow, as a matter of course—almost automatic changes.

Tight v. Slack Car Couplers.

The main results of the tests made on the Chicago, Burlington & Quincy with trains of slack and tight couplers show that though the use of tight couplings does not altogether abolish shocks, the bumps are far less severe than with the slack couplings. The slidometer was moved as follows with different styles of couplers:

Coupler.	Average slack.	Movement of slidometer.
Ames	1·7 in.	5 in. to 10 in.
Janney	0·5 in.	¼ in. to 8½ in.
Perry	2·1 in.	8 in. to 14 in.
Potter	3·1 in.	11 in. to 18 in.
"	0·3 in.	5 in. to 11 in.

The shocks were obtained in making emergency stops with trains of twenty-seven cars, including dynamometer and way car. In each case the five cars next the engine were fitted with the Westinghouse brake and Janney coupler. The remaining twenty freight cars were fitted with the coupler under trial. A consolidation was used, and the stops were at speeds varying from 22 to 44 miles an hour. Half the stops were made on a level, and half on a down grade of 53 feet per mile. In these tests all the cars were empty.

In the following tests half the cars were empty and half loaded, but the other conditions were similar:

Coupler.	Slack.	Movement of slidometer.
Perry	2·1 in.	5 in. to 8 in.
Janney	0·5 in.	1¼ in. to 7¼ in.

The results are on the whole in favor of the close coupler, but show that with emergency stops shocks are not yet wholly abolished.

A series of tests were made to further demonstrate whether as many cars could be started on a heavy grade with close couplers as with links. A train of 51 empty cars was made up, and out of this, with 15 feet of link slack, the engine succeeded in starting 46 cars.

The slack was then blocked out by placing iron wedges between the drawbars, and the same number of cars were started, apparently with less trouble, fully substantiating the results of former tests. Link slack apparently is of no advantage whatever over the spring compression in starting trains.

It may be remarked that the violence of the shocks cannot be altogether gauged by the relative movement of the slidometer. The blow with loose couplers was sharp and distinct, while that with close couplers was cushioned.—*Railroad Gazette.*

Fluatation.

Fluatation is the name applied by Messrs. Faure, Kessler & Co. to their process of hardening building stones through the application of hydrofluosilicates. The operation is very simple, and can be performed whenever desired, either upon the stone before it is put in place, or after the building or other structure is completed. The surface of the stone is covered to the desired degree with a solution of the fluate by means of a brush, sponge, or hand pump. Another application is made the next day, and a third one the day after. As a general thing, it requires three applications, although each time the stone absorbs less. The hardening takes place at once, and upon the third application becomes perfect. There are several soluble fluates, and each of them has its own peculiar properties, although all of them harden limestone. One darkens the color of the stone, another whitens it, another preserves the original color, and others again color the stone indelibly. The coloring fluates most employed are those of iron, which give a brown tint, and those of chromium and copper, which give two greens of different shades. Fluatation is applied to old structures as well as to new ones, and it is the true means of preserving the edifices that have been bequeathed to us by our fathers, and which our climate is daily tending to destroy.

After the stone has once been fluated, it becomes so hard that it can be treated like marbles and porphyries. Upon applying the colored fluates along with a subsequent polishing, very remarkable decorative effects are obtained, inasmuch as the intimate structure of the stone is brought to light, and as the nodules, veins, and fossils are delineated in different tints.

After the stone has been fluatated it can be easily rendered impermeable, and, as it is not attackable by ordinary liquids, it may be used for making tables, sinks, baths, and reservoirs for a host of liquids, such as wine, oils, alcohol, molasses, etc.

Fluatation is applied in the same way to cements, mortars, stuccoes, etc., provided they are more or less calcareous. It renders the alkalies of cements insoluble, and thus, after a washing with water to remove the excess of fluate, permits of a coating of paint being applied.—*Le Genie Civil.*

AUTOGRAPHS OF THE ELECTRIC SPARK.

BY GEO. M. HOPKINS.

Electricity of very high tension, when discharged on the surface of a body having very low conductivity, forms a luminous arborescent image, showing the path of one or more of the sparks resulting from the discharge. The erratic course taken by the spark may be due to the compression of air in the path of the discharge, or to the superior conducting power of some portions of the conductor, or to both.

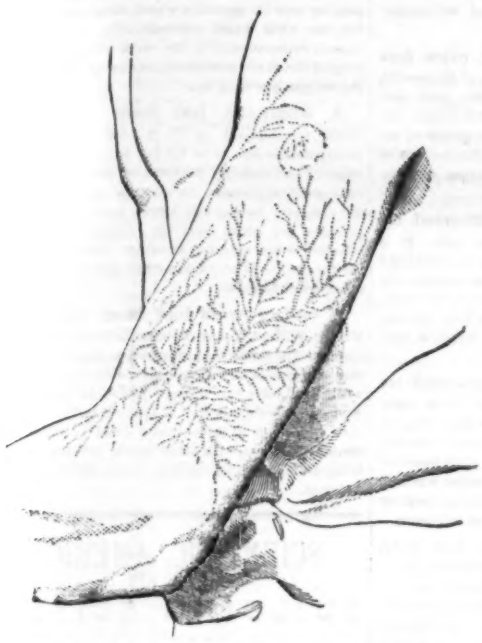


Fig. 1.—MARKS PRODUCED BY LIGHTNING.

The autographic record of such a discharge is sometimes found on the bodies of persons struck by lightning, the tree-like appearance of the marks giving rise to the erroneous notion that the lightning in some way photographs upon the body the image of trees in the vicinity of the catastrophe.

Doubtless the same marks might be produced upon the body by the discharge of a Holtz machine or a large induction coil; but this is an experiment for which it would be difficult to find a subject.

Fig. 1 is an accurate copy of a photograph taken from the arm of a boy who had been struck by lightning. Here the marks bear a striking resemblance to some forms of vegetation.

The writer in striving to secure an autographic record of high tension electrical discharges tried a large number of films before finding one sufficiently delicate to be impressed by the discharge and at the same time having enough firmness to prevent it from being blown away by the spark. A thin film of smoke on glass, fixed by means of alcohol, yielded the first results; but the difficulty of saturating the film with alcohol without destroying it was considerable. Finally, a smoke film formed on glass previously coated very slightly with kerosene oil was adopted as the most practicable. The glass was prepared for smoking by smearing it over with the oil, then removing all but a trace, then smoking it lightly over a very small gas jet or over a candle.

The glass plate thus prepared was arranged between the terminals of the induction coil, at right angles to the terminals, so that the discharge might be directly against the smoked surface of the glass, as shown in Fig. 2.

The coil employed was capable of yielding a 1½ inch spark, and the pointed terminals were separated ½ inch. A single spark, or what appeared to be such, from the negative terminal of the coil produced upon the film a spot like one of those shown in Fig. 3. These spots, to the unaided eye, appear like small holes through the film; but microscopic examination shows them as composed of a large number of very crooked lines cut out of the smoke film, and strongly resembling a tuft of wool. Fig. 4 shows a figure produced by a succession of discharges. These figures indicate the splitting up of the discharge into several branches. It might at first appear that the structure of the film would have some influence on the direction of the discharge and, consequently, on the character of the lines; but the other markings shown are so characteristic, and so evidently independent of the structure of the film, that it seems almost certain that the nature of the film had very little to do with the direction taken by the spark.

Figs. 3 to 7, inclusive, are photo-micrographs of various marks produced in the manner described, taken under a magnification of 20 diameters, and the engravings of their electro-autographs are produced by photo-engraving, without any additions or modifications whatever, so that faithful reproductions of the original work done by the electrical discharge are presented herewith. The figures numbered 3 to 6 were produced by the discharge from the negative terminal of the coil, while the marks shown in Fig. 7 were made by the discharge from the positive terminal.

The sagittate form of the larger marks in Fig. 5 are produced by a heavier discharge, and are suggestive of infernal origin. The sagittate and bird-like forms shown in Fig. 6 are of rare occurrence, but they are of substantially the same nature as those shown in Fig. 5. Figures resembling these have been seen in vacuum tubes, and sketched by De La Rue. Reproductions of some of his drawings are given in Fig. 8. 1 in this cut shows striæ in which each section resembles an arrow head, the points always extending toward the negative conductor. 2 shows the tendency of striæ to become conical. 3, 4, and 5 show sagittate forms similar to those shown in the autographs, Figs. 5 and 6, but the images of them vanished when the current ceased. 6 in Fig. 8 shows forms taken by the discharge from the positive terminal in a vacuum tube, which have substantially the same appearance as the marks shown in Fig. 7.

Two peculiarities are noticed in the marks in Fig. 7,

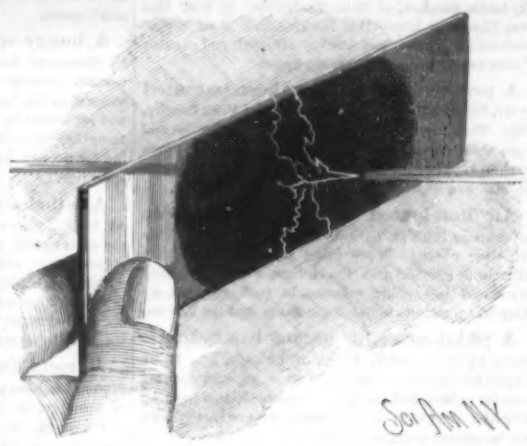


Fig. 2.—POSITION OF THE PLATE BETWEEN THE TERMINALS.

one being the longitudinal grooves in each mark, the other the evidences of the ricocheting of the spark.

De La Rue says: "The gases, in all probability, receive impulses in two directions, at right angles to each other, that from the negative being the more continuous of the two." The autographic records here shown seem to bear out this theory, since all of the arrows have lateral enlargements and point toward the negative.

The longitudinal groovings of the marks made by the sparks from the positive terminal are suggestive of a multiple discharge.

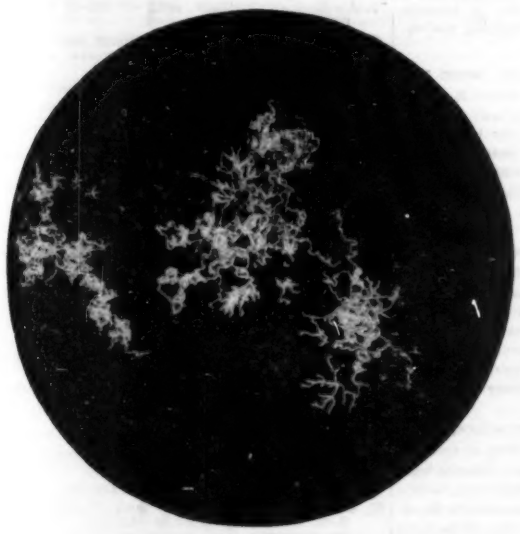


Fig. 3.

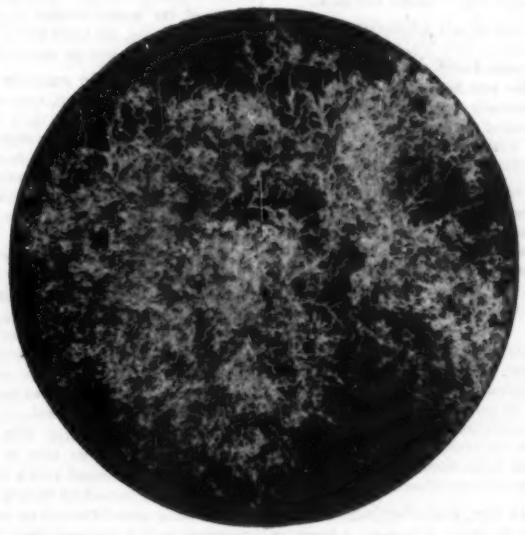


Fig. 4.

Fig. 5.

Fig. 6.

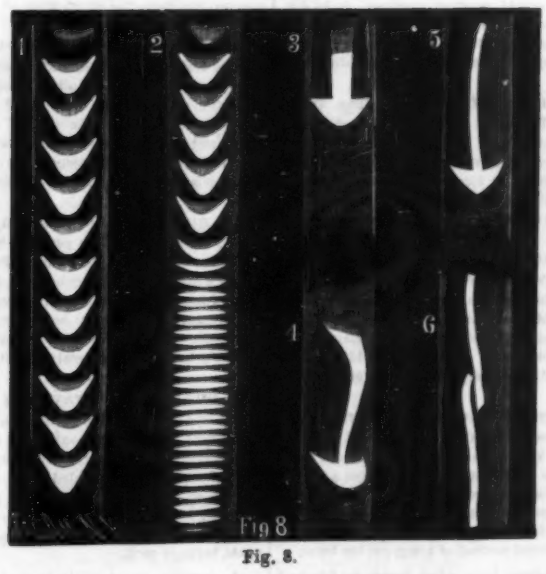


Fig. 8.

Fig. 7.

Figs. 3, 4, 5, 6, and 7.—AUTOGRAPHS OF THE ELECTRIC SPARK. Fig. 8.—FIGURES FORMED BY THE ELECTRIC DISCHARGE IN VACUUM TUBES.

ENGINEERING INVENTIONS.

A steam boiler has been patented by Mr. George Kingsley, of Leavenworth, Kansas. This invention covers improvements on a former patented invention of the same inventor, the boiler having an outer and inner shell with flattened crown piece and drop tubes communicating with the water space and descending into the fire space of the inner shell, with various other novel features.

A piston for steam engines has been patented by Messrs. William Dixon, of Sheffield, York County, and Samuel Thompson, of Trent, Stafford County, Eng. It has packing rings in a peripheral groove, a reversely beveled ring behind and bearing against the packing rings, with spring-pressed blocks behind the beveled ring, and other novel features, thus providing for the automatic expansion of the packing rings to compensate for wear.

MISCELLANEOUS INVENTIONS.

A belt buckle has been patented by Mr. Louis Sanders, of New York City. It is of that class known as ladies' belt buckles, and is of simple construction, readily and quickly adjusted, and capable of attachment to any belt having eyelets.

A process of dyeing has been patented by Mr. Thomas Holliday, of Huddersfield, York County, Eng. This invention covers the dyeing of wool and other fibers by alternately treating them with chrome, iron, copper, or lead salts to form mordants, and with the nitroso compounds derived from the naphthols.

An illuminated floral piece has been patented by Ruth E. Wilson, of Brooklyn, N. Y. This invention consists in providing a floral piece with a reflector in keeping with the design, with jets of light introduced before the reflector, in such way that air chambers intervene between the flame and the flowers.

A pedal cover for organs has been patented by Mr. James S. Foley, of Chicago, Ill. It is a hinged folding cover adapted to close the case opening over the pedals, and has a novel mechanism connecting the pedal cover with the key board cover, whereby both will be opened simultaneously.

A breeching for harness has been patented by Mr. Edwin S. Carpenter, of Corinth, Vt. It is held high upon the buttocks, at or above the portions that have alternate backward movements in the locomotion of the horse, the breeching being held in such position by attachment to the crupper by a short strap.

A label cabinet has been patented by Mr. Uriah D. Mihills, of Fond du Lac, Wis. The invention covers a curved label receptacle carried by arms pivoted in a suitable cabinet, combined with a lever for tilting the receptacle and projecting it from the cabinet, the cabinet being divided into compartments and its top inclined at an angle of about thirty-five degrees.

A folding seat has been patented by Mr. Ulysses L. Collins, of Sparta, Ill. It is for attachment to any vertical standard, wall, or stationary device, and more especially for use in connection with church pews, or with plain standards secured to the flooring of a hall or other auditorium, for which the invention provides various novel combinations of parts.

A kitchen cabinet has been patented by Mr. Orren Bates, of Wetmore, Kansas. This invention covers an article of kitchen furniture that is simple in construction, but which can be readily adjusted for different purposes, as a clothes drier, an ordinary table, a table for working dough upon, and various other uses.

A carpet fastener has been patented by Mr. Thomas W. M. Worley, of New York City. It is a plate formed with upwardly and forwardly extending spurs and a retaining shank and socket, easily attachable to the body of the carpet, so that all wrinkling and failing of the carpet between the fasteners may be avoided.

A clasp for pocket books and similar articles has been patented by Mr. Louis B. Prahar, of Brooklyn, N. Y. The hinge piece or eye is formed as part of the blank that forms the plate of the clasp, thus improving the hinge in durability and strength, and avoiding the expense and labor of soldering a separate hinge piece to the plate.

A grate has been patented by Mr. Fred C. Peslin, of Van Dyne, Wis. This invention relates to the grates of coking chambers, and is designed to facilitate the dumping of the coke from the coking chamber into the main combustion chamber, providing therefor a novel construction, combination, and arrangement of parts.

A razor has been patented by Mr. Peter Wahl, of North Vernon, Ind. It has a relatively broad back, a shank of reduced thickness, a concave blade having between its back and its edge a swell or rib for strengthening the thin blade, and rounded ends, and is designed to wear uniformly, maintain its shape, and keep a sharp edge.

A gate has been patented by Mr. Thomas J. Gross, of Maple, Mo. Its construction is such that it is not liable to be blocked by snow and ice, while it may be opened and closed from either side by means of handles as one would naturally walk, ride, or drive, being accomplished simultaneously with the approach to or departure from the gate.

A bustle has been patented by Mr. George Eckles, of Eyota, Minn. In and outer spiral spring coils are connected by clips, and have braces or stays and horizontal springs, all dependent from the waistband, in such manner as to be thoroughly elastic and easily adjustable to meet the requirements of the wearer.

Wrapping paper forms the subject of a patent issued to Mr. William H. H. Childs, of Brooklyn, N. Y. The invention consists in cementing together two or more thicknesses of paper with a paste in which is incorporated naphthaline or camphor, thus making a wrapping calculated to keep away moths from woolen cloths, furs, and articles of such description.

A toy has been patented by Mr. Samuel Pinnell, of Brooklyn, N. Y. The invention covers a novel construction and combination of parts constituting a toy railway, in which the wheeled figure is guided in its path by a radially projecting arm loosely pivoted at its inner end to the center of the track bed, and operated by a handle on the under side at the center.

A hedge fence has been patented by Mr. Hezekiah Taylor, of Shadwell, Va. The invention covers a method of using wire and bracing, in connection with one or more rows of canes trained in the required direction, so that the brace wires are connected to form a chain extending between anchor points, and the fence making can be easily and expeditiously effected.

A folding stool has been patented by Mr. Hiram F. Henry, of Gowanda, N. Y. The inside legs are pivoted to the outside legs, and the thickness of the top and of the inside legs together does not exceed that of the outside legs, whereby the stool will fold within the space occupied by the latter, making a flat stool with firm top, which can be folded in very small space.

A buggy seat has been patented by Mr. George G. Harris, of Martinsville, Ohio. The invention consists in a series of springs on a frame adapted to the buggy seat, a frame being attached to and supported by the springs, a spring-supporting back frame hinged to the seat back, with a perforated covering for the seat bottom and back, affording ventilating apertures.

A self-closing faucet has been patented by Mr. Eugene Homan, of New York City. It is for wash basins and similar uses, and the invention covers a novel construction and combination of parts in a faucet designed to be closed automatically by the pressure of the water, the valve requiring no packing, not depending on springs or screws for its action, and the parts being readily accessible for repairs.

A metallic joint for felt and other roofing has been patented by Mr. Joseph D. Brown, Jr., of Camden, N. J. The metal strips are so shaped and applied that the nails pass through them and through the roofing material at the joints between the sheets and prepared folds in the body of the sheets, the nails and strip being covered by the roofing material to conceal them and protect both from the weather.

A machine for cutting off the soiled butts of grain stalks has been patented by Mr. Lothar Becker, of Galveston, Texas. A slotted and recessed table has parallel endless bundle-carrying chains working in the slots, in connection with a circular saw, for taking off the bottoms of grain stalks which have become coated or spattered with soil so much as to interfere with ordinary threshing and separating.

A sawing machine has been patented by Mr. Alexis F. Gillet, of Burlington Junction, Mo. It is especially adapted for cross cutting sticks of timber into stove wood, and may be operated by hand or power, its construction being such that two cuts are made through the stick at once, the operator doing the sawing by turning a crank, when it is worked by hand, much easier and quicker than with saw and buck.

A hand operating attachment for sewing machines has been patented by Lois Waite McClung, of Pueblo, Col. Combined with an adjustable supporting bar arranged for attachment to the frame of the machine a lever is pivotally connected, with a link connected to the inner end of the lever and with the pitman of the machine, the arrangement being such as not to interfere with the ordinary foot driving mechanism.

A machine for making perforated glass has been patented by Messrs. Leon and Adrien Appert, of Paris, France. In combination with a bed plate for receiving fluid or semi-fluid glass is a pressure plate or roller, with a number of conical or tapered projections or prominences on the bed plate or on the pressure plate or roller, for forming glass plate with perforations as desired.

A harness has been patented by Mr. Levi Walker, of Delhi, Ontario, Canada. This invention relates to improvements in double harness when the draught evener is suspended from ordinary back pads and carried beneath the bodies of the horses, there being connected to the center of the main evener a short evener adapted to be connected at its ends by short traces to the inner hame of each horse.

An apparatus for disinfecting sewage has been patented by Mr. James J. Powers, of Brooklyn, N. Y. This invention covers a tank or receptacle supplied with sulphuric acid or other chemical, to be discharged into a generator holding a suitable salt to give off a disinfecting or precipitating gas, to be discharged into the sewage by proper connections with distributing pipes.

A watch chain attachment has been patented by Mr. Frederick W. Brueckner, of Jersey City, N. J. It consists of a light ornamental body adapted for attachment to the vest outside the pocket, the device to be made in form to represent animals, birds, or any suitable design, and to obviate the necessity of passing the chain through or connecting with a button hole.

A girth buckle for saddles has been patented by Mr. Peter J. Pefley, of Boise City, Idaho Ter. This invention covers a double buckle, consisting of two independent ones, with means for detachably securing them together, being specially adapted for buckling the double girths of Spanish saddles, while either can be used separately for a single girth in the usual manner.

A baling press has been patented by Mr. William B. Bradsby, of Greenville, Ill. It is of the class of presses known as "continuous balers," and adapted especially to take straw directly from a thrashing machine and bale it, pressing the bales to proper density with economy of time and labor, avoiding the necessity of stacking or otherwise handling the straw, and providing a novel method of tying out the bales.

A baling press has also been patented by Mr. George Ertel, of Quincy, Ill. This invention covers novel features of construction and combinations of parts to allow easy operation of the plunger, and insuring a folding of the balable material at the rear end of the baling box feed opening, providing also for automatic adjustment of the press case walls to accommodate varying conditions of the material being baled and a variable feed of it to the press.

A loop insulator has been patented by Mr. Horace Van Sands, of New York City. The coupling piece of the insulator, together with the guard and overlapping shield, are made entirely of non-conducting material, so that the adjacent edges of the shield and guard can be brought into close proximity to prevent entrance of moisture, without danger of the electric current leaping from one to the other.

An instrument for treating piles has been patented by Mr. Sylvenus B. Payne, of Ridgeville, Ind. It is a tapered cylindrical hollow bulb, with perforations in its sides, combined with a stem which has a cylindrical base piece to rest upon the exterior of the body when the instrument is in position, the instrument being calculated to facilitate the application of ointments, liquids, etc.

A game carrier has been patented by Mr. Peter Cunningham, of Brightwater, Ark. It is made of webbing, canvas, or thin leather, or other light narrow fabric, and adapted to be worn across the shoulder, suspended from a belt or carried in the hand, making a light carrier for small game or fish, the construction being such that when not in use it can be compactly folded and placed in the pocket.

A book holder has been patented by Mr. Theodor Hansen, of Brooklyn, N. Y. It is made with a base, two posts supported thereby, and adapted to support the opposite sides of an open book, one post being fixed to the base and the other to a slide movable on the base, with other novel features, making a holder which can be quickly adjusted for holding a large or small or a thick or thin book for reading or reference.

An improvement in overalls has been patented by Mr. Adolph Bookman, of Brooklyn, N. Y. They have an elastic waistband, and reversible and adjustable elastic shoulder straps, the front part of the garment being cut in one length with front fly, the braces having buckle and short buckle straps, and only needing one strapping for the desired length, while the garment may be used in hot weather, or at the option of the owner, with a single strap around the neck.

A cotton or hay press has been patented by Messrs. Allexander and Frank T. McGowen, of Houston, Texas. The head of the screw shaft is bolted to the follower, which works in a vertical press box, by means of a rotary worm wheel, whose elongated hub is threaded internally corresponding to the screw, making a combined worm wheel and nut, which sustains the weight of screw and follower and the load imposed on the latter in the act of pressing.

A knife cleaning machine has been patented by Messrs. Thomas S. Evans and Franklin R. Jackes, of Winnipeg, Manitoba, Canada. It consists in concentrically arranged cylinders having an annular space between, to whose opposite surfaces are affixed a series of spirally arranged cleaners, the lower series the reverse of the upper, adapted to revolve in an outer cylindrical casing, the knife blades remaining stationary while the cylinders are revolved.

A photographic camera has been patented by Messrs. Robert D. Gray and Henry E. Stammers, of New York City. It is a light-tight box with an adjustable lens tube and a support for holding the paper in a curved position while the picture is being taken, to compensate for the spherical aberration of the lens, there being also rollers for holding and feeding the paper and a graduated stop for stopping when desired, with other novel features.

A toy water motor has been patented by Mr. Frank E. Buddington, of Chicago, Ill. Two small reservoirs are so connected upon a plate that when one is filled, and the device placed in a vertical position, water will flow therefrom upon the paddles of a wheel between the two reservoirs, turning the wheel and then collecting in the other reservoir, after which the device may be reversed, and the former lower reservoir be made to turn the wheel.

A pin attachment for brooches, etc., has been patented by Mr. Otis G. Fisher, of Owosso, Mich. The pin is formed with a locking plate or head held in a cavity formed by the pin attachment, the pin portion being passed through an orifice made in the attachment, so that the head takes the place of the joint pin or rivet ordinarily used, and the attachment operates to facilitate the withdrawal of the pin from the garment, and also its insertion.

A hose coupling has been patented by Messrs. William H. Albee and William H. Pettys, of New York City. The coupling section has a tubular projection with a series of longitudinal wedge-shaped countersinks, so that when the end of the hose is received and clamped thereon the rubber of the hose will be crowded into the depressions, and an increased strain on the joint will compress the rubber to tighten the joint.

An apparatus for making and transferring pig metal has been patented by Messrs. John R. and Leroy A. Sell, of Johnstown, Pa. The invention covers a means, in connection with the making of pig iron, of transferring the mould or chill carrier and its moulds, chills, or troughs bodily to a point adjacent to a track, and then dumping the mould or carrier to cause the hardened pig metal to fall into a car on the track.

A bunk for railway cars has been patented by Cornelia C. Wood, of Sibley, Iowa. It is an attachment to be used as a substitute for a crib or cradle in passenger railway cars, consisting of a crane with hollow vertical post journaled in bearings attached to the side of the car, carrying a bunk in such way that a swinging motion will be given thereto by the car, but so that when not in use it will occupy the place of the usual baggage rack.

A cotton seed mill has been patented by Mr. Silamon McLean, of Mineral Springs, S. C. This invention covers a millstone with a dress formed with a series of straight furrows extending from the eye outward to within a short distance of the periphery, the remainder of the face being formed with short inclined furrows arranged in concentric circles, whereby the seed will meet with continued interruptions in its passage to the discharge spout, the mill being also adapted for grinding corn.

A clock winding mechanism has been patented by Mr. Abe Robinson, of Brooklyn, N. Y. The invention consists of a wind wheel operating a train of gear wheels connected with a sprocket wheel, a weight being hung by a pulley on an endless chain passing over the sprocket wheel, with a device for locking the wind wheel automatically, the clock being wound automatically by the wind wheel, and the running of the clock mechanism not being disturbed when the weight is wound up.

A knapsack has been patented by Henry C. Merriam, of U. S. Army. The invention covers improvements on former patented inventions, to improve and simplify the form of pack, and render the equipment adjustable to all sizes and forms of men, the knapsack having side braces held by straps, an adjustable hip strap carrying sockets in which the side braces are stepped, shoulder straps connected to the forward ends of the hip strap and to the pack, with other novel features.

A baling press has been patented by Messrs. William R. and Newton J. Green, of Kingston, Texas. The frame and case have aligned baling chambers at opposite ends, a follower with two head blocks working in them and a shaft journaled between them with two ropes connected at one end to the shaft and at their other ends to the opposite head blocks, giving a double purchase, with other novel features, the press being designed for baling hay, straw, cotton, and similar material.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

In the new "Trautwine's" the articles are systematically arranged, so that an article may often be found without the aid of the new and very full index.

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If an invention has not been patented in the United States for more than one year, it may still be patented in Canada. Cost for Canadian patent, $40. Various other foreign patents may also be obtained. For instructions address Munn & Co., SCIENTIFIC AMERICAN patent agency, 361 Broadway, New York.

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The Knowles Steam Pump Works, 113 Federal St., Boston, and 93 Liberty St., New York, have just issued a new catalogue, in which are many new and improved forms of Pumping Machinery of the single and duplex, steam and power type. This catalogue will be mailed free of charge on application.

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NEW BOOKS AND PUBLICATIONS.

THE DESIGNING OF ORDINARY IRON HIGHWAY BRIDGES. By J. A. L. Waddell. John Wiley & Sons, New York.

The object of this work is mainly to reduce the labor of designing bridges, thus facilitating the work of engineers, and to present the matter with sufficient detail and minutiæ of plans and data for estimating cost to form a compendium of information of high value to county commissioners and others who have the responsibility of erecting public bridges. The plates in the book are remarkably full and complete, showing and naming every member of bridges of the Pratt and Whipple systems, which constitute ninety per cent of all American iron highway bridges; and the tables give not only exact sizes of all the parts, but also the most economic dimensions of panels and trusses, etc. Students in bridge engineering will likewise find in this volume a valuable assistant, as the author has long been prominent as a teacher of civil engineering, and explains his subject with great clearness.

COMPARATIVE PHYSIOLOGY AND PSYCHOLOGY. By S. V. Clevenger. Jansen, McClurg & Co., Chicago.

This book is a "discussion of the evolution and relations of the mind and body of man and animals." It is the work of a physician, with the object of elaborating, as far as possible, a mental science reconciling the observations of anatomists, psychologists, and pathologists, for the more intelligent treatment of insanity. Besides years of personal investigation, the author has been a diligent student of Darwin and Herbert Spencer, of Huxley and Tyndall, and endeavors to throw such light upon his subject as the results of their reasoning and experiments suggest.

* * Any of the above books may be purchased through this office. Send for new catalogue just published. Address Munn & Co., 361 Broadway, N. Y.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) W. G. R. asks (1) how to make a starch enamel for stiffening collars, cuffs, etc. A. Use a little gum arabic thoroughly dissolved in the starch. 2. A good cough sirup. A. Put 1 quart hoarhound to 1 quart water, and boil it down to a pint; add two or three sticks of licorice and a tablespoonful of essence of lemon. 3. A "paste" metal polish for cleaning and polishing brass. A. Oxalic acid 1 part, iron peroxide 15 parts, powdered rotten stone 20 parts, palm oil 60 parts, petrolatum 4 parts. See that solids are thoroughly pulverized and sifted, then add and thoroughly incorporate oil and petrolatum. 4. Cough candy or troches. A. Tincture of squills 2 ounces, camphorated tincture of opium and tincture of tolu of each ¼ ounce, wine of ipecac ½ ounce, oil of gaultheria 4 drops, sassafras 3 drops, and of aniseseed oil 2 drops. The above mixture is to be put into 5 pounds of candy which is just ready to take from the fire; continue the boiling a little longer, so as to form into sticks.

(2) J. W. asks (1) how to oxidize silver. A. For this purpose a pint of sulphide of potassium, made by intimately mixing and heating together 2 parts of thoroughly dried potash and 1 part of sulphur powder, is used. Dissolve 2 to 3 drachms of this compound in 1¼ pints of water, and bring the liquid to a temperature of from 155° to 175° Fah., when it is ready for use. Silver objects, previously freed from dust and grease with soda lye and thorough rinsing in water, plunged into this bath are instantly covered with an iridescent film of silver sulphide, which in a few seconds more becomes blue black. The objects are then removed, rinsed off in plenty of fresh water, scratch brushed, and if necessary polished. 2. Was a census taken in Massachusetts about 1770? If so, where can the returns be found? A. The first national census was taken in 1790, and the first independent Massachusetts census in 1857.

(3) C. D. F. asks what a sample of wax sent is composed of, and a receipt for moulding wax for artists. A. To determine the composition of the sample would require an analysis. For a moulding wax try the following: Melt over a moderate fire 100 parts of yellow wax, and add 13 parts of Venetian turpentine, 6½ parts of lard, 73½ parts of elutriated bole. Mix thoroughly, pour the mixture gradually into a vessel containing water, and knead it several times with the hands. The wax must be melted at a temperature sufficiently low not to create bubbles. Add Indian red if desired for color.

(4) W. J. W. asks where he can get a light and cheap lapidary's outfit. A. This class of appliances is not on sale. A frame with wheel, shaft and spindle, placed in a vertical position, with two or three lead laps, one for coarse emery, one for fine emery, and one for polishing, also a lap made with end wood on a chuck for polishing, and a leather polisher, desirable for rounded work, are all that is needed. A thin disk of copper mounted on ordinary lathe spindle is used for slitting with emery. If you wish to use diamond dust, a sheet steel disk, very thin, should be used. Any machine shop can produce these.

(5) C. H. F. asks how the conducting power of heat in metals compares with that of glass. A. Glass is a poor conductor of heat for transmission. Iron transmits thirty times more heat than glass under the same conditions. Brass is about midway between iron and copper, copper being eighty times better as a conductor than glass.

(6) J. J. P. asks: Would the dynamo described in SUPPLEMENT 161 produce the same amount of current if the layers of wire on the field magnets were wound in parallel circuit? A. With the present armature, no. 2. What size wire would be necessary to wind the armature for plating? A. Armature No. 14, field magnet No. 14, or with two No. 16 wires wound parallel.

(7) J. C. P. writes: At the bottom of page 278 of your last edition (No. 18) there is the following statement: "The outer terminal of the coil is connected with one of the screws, and the inner terminal of the same coil is connected with the screw in the next bar in order in the commutator cylinder." If this was done, how is the circuit made through the armature? A. The inner end of one coil is connected with the outer end of the adjacent coil at the screw of of the commutator bar, so that the circuit is from one coil to the commutator bar, then back to the outer end of the next coil, then through this coil to the next commutator bar, thus back to the next coil in order and so on, thus completing the closed circuit of the armature. This point is clearly stated in the article referred to.

(8) D. F. F. asks the formula for the paper torpedoes sold on 4th of July. A. The explosive material is fulminate of mercury.

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May 10, 1887,

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